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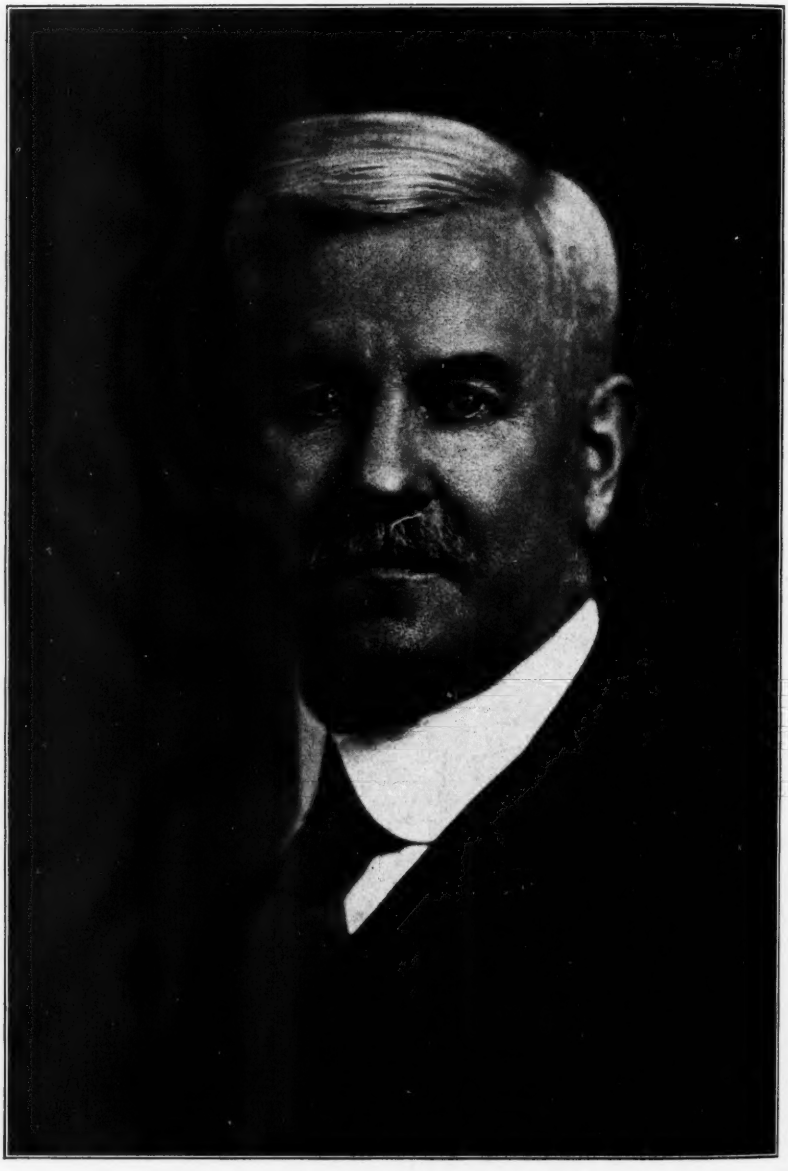

ARTHUR R. MELENDY, D.D.S.
Treasurer of the American Dental Association, 1915-1928
Died, May 22, 1928.

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Original Communications

PROGRESS IN OPERATIVE DENTISTRY IN RECENT YEARS*

BY ARTHUR D. BLACK, M.D., D.D.S., Chicago, Ill.

FOR the purposes of this paper, the term "operative dentistry" is applied to all procedures concerned with the treatment of dental caries. It therefore includes measures for prevention, for control and for repair of the injuries to the teeth by caries. Studies of the etiology and pathology of caries will be briefly reviewed, since advances in treatment result, as a rule, from better understanding of causes and tissue changes.

The development of present-day knowledge of dental caries may be said to have begun with the work of Robertson, of England, who, in 1835, published a small book in which he not only expressed the belief that decay resulted from acid generated by the decomposition of food particles or fluids, but also called attention for the first time to the fact that the process practically always began at certain spots where lodgments might occur. As a result of his studies of the beginnings of decay—small cavities—he was able to classify cavities as we classify them today, pit and fissure, proximal and gingival third, although he did not use the same terms. Robertson's work was the basis for much that has been accomplished in the ninety-odd years which have elapsed since his book was published.

During the period of about fifty years, from Robertson to Miller, there were many discussions of decay as an inflammatory process, as a chemical process, as a chemicovital process and as a result of micro-organic action. These writings cannot be reviewed in detail in this paper. It is sufficient to say that they appear to have been necessary forerunners of that which was to follow. The development of the microscope and of methods of studying micro-organisms was also essential.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 27, 1927.

It remained for W. D. Miller to demonstrate that lactic acid formed by micro-organisms caused the calcium salts of the tooth to be dissolved. Miller's studies were epoch making in that they settled once for all this one link in the chain. Miller's work was confined largely to caries of dentin, but it established the basis for subsequent developments in the pathology of decay of enamel.

Almost immediately following Miller's work came the researches of J. Leon Williams and G. V. Black, on caries of enamel, and the principle was laid down by Black that "for caries to begin in the enamel of the teeth anywhere, the caries fungus, which forms an acid, must be attached to the surface of the enamel in some such way as to prevent the acid which it forms from being readily washed away and dissipated in the general fluids of the mouth."

Studies of the points of beginning and surface spreading of decay led to the establishment of the rules of "extension for prevention" in 1895. There followed fifteen or more years of debate on G. V. Black's principles of cavity preparation, as a result of which they were adopted by all dental colleges and by the profession as standard.

At this time, about 1910, the generally accepted theory regarding dental caries was that something in the saliva, decomposition of food débris, etc., permitted or promoted the action of lactic acid forming micro-organisms, and as a result of protection afforded in one way or another, at certain positions on the teeth, the acid was held in concentrated form in contact with the surface of the enamel, and the calcium salts were dissolved out, producing a cavity.

During recent years, the trend of many studies has been along different lines. Most researches on diet in relation to caries have been based on the supposition that faulty tooth structure is the controlling factor and that the structure of the teeth could be regulated through diet. If this could be proved, it should be possible to solve the whole problem of susceptibility and immunity to decay by studies of diet. In my opinion, this contention has not been established, notwithstanding the splendid research that has been done. In fact, the careful researches of Black, Williams and Tomes agree that the variations in calcium in teeth under all conditions is too slight to have any bearing on susceptibility to caries. It seems rather curious that no one has been inclined to make extensive studies of diet in relation to the environment of the teeth, thus connecting directly with the best scientific research of preceding years.

The clinical problem of controlling dental caries is naturally based upon our present-day knowledge of the etiology and the pathology. Until we know more of the relation of diet to susceptibility, we will use our best judgment in recommending a diet which promises most for the development of a healthy body. In the mouths of our patients, we find a wide range from absolute immunity to extreme susceptibility, which we may account for only in part, and which constantly reminds us of extensive research yet to be done. We can go back to Robertson for the locations of the beginnings of decay. We do know from the work of Miller, Black, Williams and others that decay spreads certain distances in various directions on the surface, and that the dissolution of the structure of the tooth is due to an acid that is protected and held in concentrated form on the particular spot on the enamel. Our efforts must, therefore, be directed against these areas and we must apply our knowledge of the physical properties of filling ma-

terials in order that operations may preserve the remainder of each tooth for the longest possible time.

We may refer briefly to the early days when amalgam and noncohesive gold were in general use as filling materials. During this time, the operation consisted of removing the decay and filling the hole, without much attention to the restoration of tooth form. The discovery of the cohesive property of gold foil made possible the building of "contour" fillings, with which normal tooth form, including contacts, might be restored. Improvements in the manufacture of amalgam alloys, so that shrinkage and expansion could be controlled, constituted the next advance. Next came the gold inlay, which affords easy opportunity to make the most perfect restorations of both tooth form and contact; also the porcelain inlay, by which excellent restorations of both form and color can be made.

Operative dentistry is ever striving for the better control of caries, with prevention as the eventual goal. As we make progress, the entire practice of dentistry should be modified. The average size of fillings should be smaller; the number of decayed areas per person; the number of pulps involved, of teeth extracted, of crowns, bridges and dentures placed should be less; the number of cases of irregularity should be fewer, and the chronic infections about the teeth should be reduced in like proportion.

One of the most important forward steps made by the profession in recent years has been the education of a considerable percentage of our patients to the value of periodic mouth examinations. An ever increasing number of dentists have put their practice on a "periodic notice" basis, by which the dentist assumes the responsibility of notifying the patient when to return and the patient accepts the plan as one designed for his benefit.

Many dentists seem to have looked on this plan as desirable in the building and maintenance of a practice, while overlooking its greatest value, the opportunity to better control dental caries. It establishes an entirely new relationship between dentist and patient; it gives the dentist an opportunity to assume the same supervision over the mouth that an engineer assumes over any piece of apparatus or machinery for the condition of which he is responsible. It is inspected frequently, on each occasion attention being given to any part which is not functioning properly. The machine is kept in good running order. Little can be accomplished in the control of caries in the mouth of a susceptible person who will not agree to a plan of periodic examinations.

The next important advance has been made in the general improvement in the care and attention given to mouth examinations. These are being made with greater thoroughness than ever before. Many dentists are making complete records of mouth examinations, which include the care by the patient, inflammations of the soft tissues, condition of contacts, vitality of pulps and the condition of the adjacent bone structure as shown by roentgenograms. A better understanding of oral pathology in relation to general health and of the importance of conserving pulps and pericemental tissues has prompted more careful examinations.

It scarcely seems necessary to call attention to the fact that periodic examinations, painstakingly made, provide the opportunity for the utmost conservation of the teeth.

The third important advance has been in the development of greater interest in the care of children's teeth. This has resulted in part from a realization of the fact that progress in operative dentistry depends on getting closer to the beginning, when it is possible to promote conditions which will establish near-immunity much earlier in life.

The coming of the dental hygienist is evidence of a better appreciation of the importance of proper care of children's teeth. The education of school children in matters of dental health and their training in the care of their own teeth are probably the most important forward steps in the past twenty-five years, coming closer to the source than any other measure, as applied to the mass of our children. If the lower grades of every school in this country could have the services of competent dental hygienists, it is probable that the number of teeth requiring pulp treatment, also the number extracted, for the oncoming generation would be reduced by more than half, with a corresponding diminution later in life in systemic conditions resulting from neglect of the teeth in youth. It is impossible now to estimate the effect of such training on the attitude of the mass of people of the next generation toward dental service and the demand for that service. If but 10 per cent are regular patients today, might we not expect an increase to 50 or 60 per cent?

The individual dentist is, we believe, more interested than ever before in caring for the teeth of the children of his clientele. If one looks backward from the present generation of adults, about 75 per cent of whom have chronic mouth infections, it is plain that the real source of these is to be found in neglect during childhood. It has become the dentists' duty to think of his child patients in terms of their life expectancy and to make it his obligation to have the oncoming generation of his patients reach adult life with healthier mouths and consequently healthier bodies than the average adult of today.

It is the main objective of this paper to emphasize the fact that we now have the means of accomplishing much for the better health of our people. With the knowledge and methods at hand, more wisely and carefully applied, the record of achievement for the next decade should show great progress. The dentist should consider each child as a problem. He should rate each child in the scale of susceptibility and then lay out a program intended to carry the child through to adult life. This program should include, in the first instance, the frequency of periodic examination. For the nearly immune, once in six months, even at an age below 6 years, might be sufficient; for the susceptible child, once in two or three months might be best.

The dentist should offer to notify the patient when he should return for examination, and thus assume responsibility for this important and basic part of the program.

In estimating susceptibility, one should take into consideration the age, the number of cavities, the number of fillings as indicating previous decay, the habits as to mouth cleanliness, the apparent use of the teeth in mastication, the mental attitude, the nervous condition, etc. Often, all of these things may be rather accurately estimated within a few minutes at a first visit.

The program should include a plan for the management of the child, in order that cooperation may be secured in the keeping of appointments, in home care, in behavior at the office and all of those things which make for success.

Temporary operations are often desirable for young children to carry them along to a time when permanent fillings may be made without too great a strain on them. Also, in very susceptible children with a large number of sensitive cavities, it is often best to remove the decay without attempting proper cavity preparation, and place cement in all the cavities, thus restoring the teeth to vigorous use in mastication and relieving much of the sensitiveness. The cement fillings may then be gradually replaced with permanent fillings.

extension for prevention. The susceptible child should have more frequent prophylaxis and the most careful guidance and observation as to the home care.

In the selection of filling materials, the physical qualities of each should have the same consideration and study as would be given by an architect to the materials which go to make up a building. A shack which is expected to last a few months may be put together carelessly of perishable materials, but a building that is to withstand the test of time must have every factor right. Rules for

TABLE 1.—COMPARISON OF THE DESIRABLE QUALITIES OF SEVERAL FILLING MATERIALS

Qualities most desired	*Gold Foil*	*Amalgam*	*Gold Inlay*	*Porcelain Inlay*	*Silicious Cement*
1. Indestructibility in the fluids of the mouth.	a	a	a	a	d
2. Adaptability to cavity walls.....	a	b	c	c	d
3. Freedom from shrinkage and expansion....	a	a-z	a	a	d
4. Resistance to force of mastication	a	b	a	c	d
Qualities of secondary importance					
5. Color, or appearance	c	d	c	a	a-z
6. Nonconductivity of thermal changes.....	c	c	b	a	a
7. Convenience of manipulation	c	b	a	d	a

Explanation: a, highest quality; b, next; c, third; d, lowest quality. a-z is used to represent the extremes possible, from perfection to absolute worthlessness in amalgam as to shrinkage or expansion, depending on its manufacture. a-z is also used to represent the extremes in appearance of silicious cements.

In making a choice of permanent filling materials, it is of importance that several factors have consideration; possibly the most important being the age of the patient, the degree of susceptibility, the physical qualities of the several filling materials as an indication of their permanence, and the personal equation of the operator himself in his ability to manipulate these materials.

The child should have the best service in quality and permanence, because of its greater expectancy of life. The degree of susceptibility should be a guide as to the frequency of examination and the preparation of cavities under the rules of

our guidance in the selection of filling materials have been laid down. These include study of the physical qualities of the materials and their adaptability to the conditions under which they must survive or perish. The dentist who does not pay careful attention to these fundamentals in the selection of filling materials is neglecting his highest duty. The dentist who, knowing that one material is better than another in point of tooth conservation and protection of general health, has not the strength of character or moral courage to insist on using it in preference to a less stable material, more easily manipulated, is not living up to

the ideals for which our profession should stand.

The qualities most desired in a filling material for permanent operations are: indestructability in the fluids of the mouth, adaptability to the walls of cavities, freedom from shrinkage and expansion after having been made into fillings, resistance to attrition and sustaining power against the force of mastication.

The qualities of secondary importance are color, or appearance, non-conductivity of thermal impressions, and convenience of manipulation.[1]

degree, and to rate third in the qualities of secondary importance. The gold inlay ranks close to the gold foil filling, the main point of difference being the lack of adaptability. Cement is the substitute, carrying with it the danger of washing out and the advantage of partial insulation against thermal changes. High-grade amalgam ranks a very close second to both the gold foil filling and the gold inlay in the most desired qualities. In making this statement, emphasis should

TABLE 2.—SUGGESTED ORDER OF SELECTION OF FILLING MATERIALS FOR SEVERAL CAVITY GROUPS

Classification of Cavities	Gold Foil	Amalgam	Gold Inlay	Porcelain Inlay	Silicious Cement
Bicuspids and molars					
Small and medium size pit and fissure	1	2	3	..	..
Large pit and fissure	..	2	1	2	..
Small mesioclusal and some distoclusal of easy access	1	3	2	..	..
Small distoclusal of difficult access and large mesioclusal or distoclusal	..	2	1	3	..
Gingival third	1	2	3	..	..
Incisors and cuspids					
Small proximal	1	..	..	..	..
Large proximal	2	..	3	1	4
Proximo-incisal	3	..	2	1	..
Gingival third	2	..	..	1	3

Explanation: The figures represent the first, second, third and fourth choice under average conditions. This table is suggestive only, as it is appreciated that many factors must be considered. For example, in the incisors and cuspids, for large proximal or proximo-incisal cavities, gold foil or gold inlays would be preferred to porcelain in mouths in which the appearance is of little importance. The age of the patient is an important factor in many cases, as is the personal equation of the operator.

It is not the intention to discuss these qualities in detail as applied to the filling materials now in general use, but to suggest the importance of careful study of materials in relation to the varying service demands of practice.

Table 1 gives a comparison of the physical qualities of five filling materials in use at the present time.

This chart shows gold foil to possess the most desirable qualities in the highest

be placed on the term "high-grade amalgam" which is so prepared that it is guaranteed against shrinkage and expansion. Unfortunately, the bulk of the amalgam sold today is not high grade, apparently because this costs a little more —possibly about five cents a filling. It is a serious reflection on the attitude of the profession that there should be a demand for other than tested alloys.

The porcelain inlay ranks with the gold inlay, except for its lack of ability to resist the stress of mastication and its

1. Black, G. V.: Operative Dentistry, Ed. 6, vol. 2, p. 224.

difficulty of manipulation. It excels all other so-called permanent filling materials in its nonconductivity of thermal changes.

A column has been included in the table for silicious cement, because this material is being used so often instead of one of the more permanent materials. This material meets in no reasonable measure any of the qualities most desired. In the large majority of cases, it deteriorates rapidly in the fluids of the mouth; it is not adaptable to cavity walls in the sense that either gold foil or the ordinary cements hermetically seal cavities; it is not free from shrinkage, and offers only slight resistance to the stress of mastication. As indicated in the chart, its appearance may be anywhere from a to z. The extensive use of this material in recent years is a distinct backward step in the field of operative dentistry.

Table 2 suggests the order of selection of filling materials for the several cavity groups. These data are based largely on my own experience, and are subject to many variations. It would not be practicable to fill all of any particular type of cavity in the same way. The age, susceptibility and temperament of the patient should have consideration, as should also the personal equation of the operator. He should not use a material which he has not the ability to manipulate with reasonable success; he should, however, aspire to become expert in the use of every good method.

Two things should probably be uppermost in our minds in laying out our program for the individual patient—age and susceptibility. The younger the person, the longer the life expectancy; the greater the susceptibility, the more care, fine judgment and good management required for success. As early in life as conditions permit, the most painstaking operations, calculated to last the longest, should be made for the child. This field, in which too many have temporized and lost, we are coming to recognize as the most important for thoroughly good service. For the person advanced in years, it is of less consequence if we temporize or use poor judgment.

It appears that, in recent years, there has been a marked improvement in the management of proximal decay in the bicuspid and molar teeth. This is due in part to the stress that has been laid on the importance of saving the first molars, and in part to the advent of the gold inlay, the use of which compelled better cavity preparation, and also made it easy to restore contacts to good form.

The management of proximal cavities in the incisors and cuspids has not been so satisfactory during the past ten years. This is due to the too extensive use of silicious cements in place of gold foil. The substitution of the gold inlay for foil in the back teeth inclined many operators away from the use of foil, and the difficulties of manipulating foil in proximal cavities in the incisors, combined with the splendid initial appearance of the easily placed silicious cement, completed their downfall. Many members of the profession appear to have used poor judgment in their management of proximal decay in the front teeth, if we presume that they are conscientious and are anxious to give their patients the best service. Those who are using silicious cements extensively in these cavities are urged to compile the "life history" of teeth so treated, recording the ages of patients and the date when each successive operation was made in each cavity, including a record of pulp deaths, and the date on which a porcelain jacket crown was required.

As compared with such a record, take those of many adults of today who had excellent proximal gold foil fillings made in the incisors when they were children; also when the cavities were small. We all know that, if the fillings were well made, the majority have remained in place through many years, often throughout a long life, and pulps and pericemental membrances have been conserved. Of all positions in the mouth, small proximal cavities in the front teeth most insistently call for gold foil fillings, particularly in children. If these cavities are discovered early, the labial cavity wall should not be cut so wide as to make an objectionable showing of gold, and the filling should last a lifetime. On the other hand, the average life of silicious cement fillings is probably less than two years, during which period a good contact is not maintained and recurrence of decay is likely.

In considering the future of operative dentistry, it is most important that the dentist's vision shall be broader, that he shall think and manage cases in terms of life expectancy, and that, above all, he shall apply himself most seriously to the care of the teeth and the training of the young child, with the realization that the future mouth health and much of the general health of that child when grown depends on his care and management.

DISCUSSION

John V. Conzett, Dubuque, Iowa: The work of Miller, Williams and G. V. Black on the etiology of dental caries has never been successfully controverted, standing today, as it did in the days when it was first promulgated, as the most reasonable hypothesis to account for the destruction of the dental organs through the medium of decay. That diet has a large place in the etiology of decay is admitted, for it is on a suitable pabulum that the organisms of decay must depend for the substance from which to elaborate the acid which breaks down the enamel rods in the beginning of caries. But that the food that the child eats exerts any appreciable effect on the density of the tooth, and on its consequent resistance to decay, has never been demonstrated to the satisfaction of thinking men. Every observer knows that decay does not run a regular and continued course, but is intermittent in its attacks on the individual, being rampant at one stage of his career, and at another quiescent, one or more periods of susceptibility being followed by stages of immunity. I think that G. V. Black stated that, in his mouth, he had had three periods of susceptibility, followed by a like number of periods of immunity. This is the case in most mouths. Our patients present a mouthful of teeth that are decayed, and, after treatment, these teeth will not show caries for a number of years, when they will present a number of cavities again; and this sequence will occur several times during the lifetime of the individual. If it were simply the density of the tooth structure that made for decay or immunity to the carious process, we would expect it to be continuous once it began; for the structure of the tooth, for the most part at least, is the same, and the diet will not materially affect the condition of the tooth *per se*. That the diet will materially affect the process of decay through furnishing a hospitable medium for the life processes of the acid-forming bacteria is undoubtedly true. Diet in its relation to dental caries is a vital subject from that standpoint, and should be more seriously studied and taught to patients. In my practice, I have time and again demonstrated its efficacy in changing conditions in a mouth that was extremely susceptible to caries, to a condition of comparative immunity. I do not think that the structure of the teeth changed in any material manner, if at all, but I do think that the condition of the oral secretions was so modified that it was not possible for the organisms of decay to carry on their destructive work under the changed conditions that were brought about by a change in the diet. Dr. Black just touched on the work of G. V. Black in the doctrine of extension for prevention, and the work that he did in giving us his system of cavity preparation for the reception of fillings. Recently, there appeared in the *Dental Cosmos* an editorial deploring the retrogression of operative ability, and inferring that it was largely due to the advent of the cast gold inlay, in that the inlay made the

work of the operative dentist so much easier that he, taking the line of least resistance, failed to measure up to the standards of the older operators. That there is a great truth in that contention is an undoubted and deplorable fact. The situation is analogous to the decadence of prosthetic dentistry on the advent of rubber; and yet it was not rubber that caused the decadence, for we now recognize it as a most valuable material in denture construction, and most artistic results are obtained by its use. It was the apparent ease that attended its use that made for carelessness, and induced the slovenly and ill-prepared man who could not make one with the less tractable metal base, to construct dentures with it. The same is true of the cast gold inlay. Men that could not make a decent filling with gold foil immediately began to make inlays in the slovenly manner in which they made amalgam fillings, and the apparent ease of the introduction of the inlay caused a lessening of their care in cavity preparation and consequent breaking away from the tenets laid down by the masters of operative dentistry of the past. It is not the use of the inlay that has caused the decadence, but its *abuse*. It requires just as much skill, and I think sometimes more skill, to make a good inlay than it does to make a foil filling and to do so requires a knowledge of the fundamental principles of cavity preparation laid down by Black, just as surely as does the making of a foil or an amalgam filling. If we are to teach anything, we must adhere to ideals; for if we depart from them. we may be sure that our pupils will take their key from our work, and go farther than we dreamed they would do, to their hurt and the destruction of operative ideals. I have always taught that, according to the principles of Black, the cavity for a gold inlay should have flat seats and parallel walls. Some of my critics have advised against that, and have taught their pupils to make cavities with slightly conical walls. While it may be permissible to have the cavity walls slightly converge as they approach the gingival or pulpal walls, and this may not materially affect the retention of the inlay, the doctrine is a dangerous one; for the pupil taught that method feels that if a little is good, more is better, and we get the cone-shaped cavity with the buccogingival and linguogingival angles so far within the embrasures that the whole work is useless. If we teach the ideal and call for flat seats and parallel walls, we will instil a desire to approach the ideal as closely as possible, and while few students will make an absolutely parallel wall, they will get close enough to it to make an inlay that will have a splendid retention, and one that will have the gingival angles carried out to lines of comparative immunity to decay. I wish to emphasize the importance of calling patients for periodic examination and prophylactic care. I know of nothing that I do for my patients that compares with that service. They are called by my secretary at various periods according to the needs of the case. If there is a decided inclination to caries or pyorrhea, they are called at more frequent intervals. The average patient comes once in three months. Some come every six months and some every month. The last are usually the ones that have had recent treatments for pyorrhea and are under observation. When the condition of the gums warrants, they are called at less frequent intervals. In this manner, we are able to keep track of the condition of the teeth and gums, and, as a result, we have little pulpal and apical disease among our regular patients. Dr. Black's classifications are most valuable, and I fully endorse them though I might modify some of them in my personal practice, just as you would, for as he says, the personal equation of the operator and his ability in the use of the various materials must enter into a consideration of the method to use. Finally, let me heartily endorse all that Dr. Black has said about the silicates.

George H. Means, Louisville, Ky.: We all agree with Dr. Black in regard to the "periodic notices" for oral examination which he recommends that we send to our patients, not as a practice building idea but for better control of dental caries; provided these notices are sent to our own patients only. But therein lies the danger. We never know when a patient has passed into the practice of another dentist until later, and if our notice for oral examination is sent to some one who has become the patient of another dentist, it places one in the light of soliciting business. This cannot be foreseen, of course, but I do recommend that a notice be sent to a certain patient only once and not again until he has presented himself at your office for dental services. Then his name may again be placed on the mailing list. I agree that mouth examinations are being made with a greater degree of thoroughness than formerly, but I regret to say that I have not found for sale,

in the dental market, a diagnostic sheet that I regard as comprehensive and practical. I have seen some which were good, but they were the personal property of some individual or study club or dental school and were not for sale at our supply houses so that few dentists have them. I hope this condition may soon be remedied. Dr. Black, in his closing paragraph, says that it is most important that the dentist's vision shall be broader and that he shall think and manage cases in terms of life expectancy. And for this the thorough use of a comprehensive diagnostic sheet is required, and to measure up to it fully, I believe that yearly study models and full mouth roentgenograms are a necessity. By this method, the standard of dentistry can be raised to a much higher plane. I rejoiced in hearing Dr. Black emphasize the importance of dental services for children. I fear that in the past the recollection of a few unmanageable children has acted as a damper to inspiration in the consideration of this important field. But the new idea of children's work is the realization that in them we have, as a rule, our most pleasing and cooperative patients, with fewer "come-back" complaints, and it is the dentist's own fault if this work has not been sufficiently interesting to him. I have considered with interest Dr. Black's choice of filling materials and noted that gold foil led all the rest. With all due respect to the other filling materials before the profession, I firmly believe that gold foil is by far the best we have ever had, all things considered. And I heartily agree that the "silicious cement meets in no reasonable measure of any of the qualities most desired" in a filling material. I will go further than that and say that I regard the use of the silicious cement, as it is at present, as the shame of the dental profession, owing to the fact that, as Dr. Black has said, "the average life of this filling material in good condition is probably less than two years," and we know that each replacement consumes more tooth structure; also, that during much of the time it remained in the tooth it held no contact point and consequently predisposed the tooth and the approximating one to periodontal trouble, to say nothing of the frequent destruction of pulps. But there is one redeeming thought: the profession is honest; and is to be commended in its effort to perfect an esthetic filling material. It is probably true that an esthetic filling material will never be perfected in the laboratory, but must be proved effective in the human mouth against the agencies that work for its destruction; namely, the stress of mastication, and dissolution by the oral fluids, and the abuse by the patient in cleaning the teeth with the brush, toothpick and floss. Dr. Black urges that those using this filling material keep accurate data as to the results, and I will suggest that the research departments of our dental schools collect data as to the analysis of the oral fluids of patients who do and do not wear silicious cements to advantage. We all know that some patients do get good service from silicate and others do not. Is it because of the nature of the oral fluids? Can a practical test be made by a dentist which will foretell whether a patient will receive good service from a silicious cement? It seems to me this is a fertile field for investigation.

Dr. Black (closing): I am glad that Dr. Means presented the criticism of periodic examinations. The man who attempts to conduct periodic examinations by sending patients notices when they should come in might injure his practice and get into trouble with other dentists unless he is very careful. I am sure I am within the point of safety when I say that 95 per cent of my patients are on this basis. When we are through with a series of operations for a patient, I say to the patient: "Your mouth should be examined in six months. If you wish me to, I will make a memorandum to send you a notice." I always make the provision, "If you wish me to." At the specified time, we write a note saying, "In accordance with your request, I am enclosing an appointment card for examination. If it is not convenient for you to keep this appointment, please call up by phone and cancel it." The patient may have some good reason for not wishing to return, and we wish to avoid the criticism that we are "tying a string" to him. I know many dentists who are following this plan. It is a suggestion to patients that they take care of their teeth on much the same plan that they care for their automobiles by having the oil changed every five hundred miles, and having the car greased and inspected at stated intervals. As to the diagnostic chart, you do not need anything elaborate. Use any examination chart you have. You can mark on the chart the cavities as you ordinarily do with black ink or lead pencil. You can use red ink or a red pencil to mark inflammations of the gingivae. The age of the patient and other notations may be made in any conven-

ient place, or on the reverse side. In some instances, too elaborate charts have been developed and the plan was soon discontinued. Just put down the few things that are most essential. This can be done on any chart. I would like to say this word regarding children. I tell our senior students that the greatest asset that they can have in building a practice accrues through taking good care of children, because they are likely to be their best boosters through life. The child who really becomes a good patient is going to be your friend, and he will "root" for you as hard as he would for a football team. The most important thing of all is to have constantly in mind what a full set of roentgenograms of the child's mouth will show when it has grown. There is no other phase of dentistry that is such an asset in practice building as the correct care of children's teeth.

THE PHYSIOLOGIC FACTORS AND THE MECHANICAL FEATURES INVOLVED IN THE APPLICATION OF LIGHT RESILIENT ARCH WIRES*

By EDWARD M. GRIFFIN, D.D.S., Portland, Ore.

THE employment of small gage wires for the application of light resilient pressure is no innovation in orthodontics. The desirability of producing purely physiologic growth as the result of mechanical stimulation during treatment has decidedly augmented the trend toward delicacy in appliance construction. Many operators now employ small gage auxiliary springs in combination with a base wire of much larger gage, practically all the tooth movement being accomplished by the so-called finger springs. Another application is that of alinement wires used extensively with the tube attachments, and still another application is the small gage wire used in conjunction with the Angle appliance. However, the technic of employing small gage round wire arches in conjunction with a fixed attachment, which renders the arches themselves active functioning units for the delivery of spring pressure, has been given little considration in orthodontic procedures to date.

Current orthodontic literature reveals that the types of appliance construction in favor today are varied, also that the opinions of several eminent practitioners differ concerning the respective efficiency of appliances and the true nature of the reaction on the tissues resulting from their use. All endeavors in the orthodontic field converge toward one goal; namely, "to assist Nature in the development of a masticatory apparatus which constitutes an assemblage of parts best suited to the functional activities of the organism as a whole," as explained by A. Le Roy Johnson.[1]

Contemporary writers agree that living bone is the most labile, the most plastic structure of the whole organic complex. It is apparent that the associated tissues may be visualized as a delicate structure composed of millions of cells which are responsive to the most

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

1. Johnson, A. L.: Tissue Changes Involved in Tooth Movement, Internat. J. Orthodon., 12 (Oct.) 1926; Basic Principles of Orthodontia, Dent. Cosmos, 65: 397, 503, 596, 719, 845, 957 (April-Sept.) 1923.

delicate stimuli and that such stimulation produces a rearrangement of the cellular elements along definite lines to best resist the stresses to which they are subjected.

In my experience, the application of delicate resilient pressure is, from a mechanical standpoint, very desirable in the production of all tooth movements. It seems of vital importance that operators in the orthodontic field at all times watch closely the tone of the investing tissues of teeth which are being subjected to any mechanical force. The operator

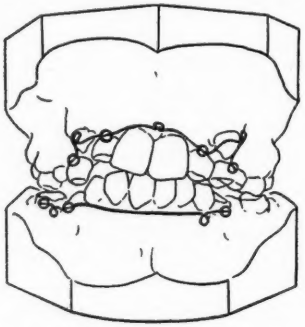

Fig. 1.—Application of labial accessory arches in typical case.

should sense quickly the border line between tissue stimulated to a point of producing cellular activity and tissues in a state of inflammatory reaction. Many orthodontists are now convinced that both excessive stimulation and mechanical fixation are conducive to atrophy of tissue. It is my observation, from a clinical standpoint, that there is considerable range in the degree of force which *can* be applied in the movement of teeth before permanent injury may result and the amount of force which *should* be applied for a reaction which will result most favorably as we influence the metabolism of cellular structures. Also, the more severe the maldevelopment, the lighter the force needed to produce a greater stimulation physiologically; for the slightest tendency toward irritation in severe conditions only defeats our purpose in attempting to cause regeneration of tissue.

The appliance construction presents the following technic. The arch wires are constructed of alloy wire ranging from 0.018 to 0.025 inch in diameter, or from 25 to 22 gage. The appliance is constructed to suit the requirements of the individual case, as to both design and gage of the respective arches. It is

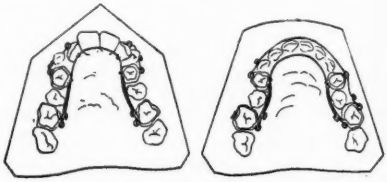

Fig. 2.—Left: Stabilizing of group anchorage, employing an accessory stabilizing wire, from the molar to the first bicuspid in conjunction with the lingual arch. Right: Application of the accessory labial arch in conjunction with the lingual arch for opening spaces presenting impacted or partially impacted teeth.

changed from time to time according to the needs of the case as it changes in its development toward completion. In this manner, the minimum amount of appliance mechanism is in the mouth at all times according to the use being made of it.

The light resilient arch wire, being nonrigid, is made to conform to the size and shape of the dental arch, and is so flexible that it can be readily sprung to the size and shape of the arch as it is, with the teeth in malocclusion. It is so resilient that it will, when properly locked to the teeth, carry them toward their proper places. It is necessary, as adjustments are made during treatment,

to reshape the arch wire, each time making it conform to the ideal as conceived by the operator. The advantage is that the small gage wire may be adjusted so that it will be effective on the teeth throughout the length of the arch for a considerable period of time without exerting more than a very slight pressure. It may be adjusted so carefully to the teeth in malposition that the forces of mastication do not "punish" the arch wires, and thereby cause frequent breakage in small gage construction, as might be expected. Also, the small bulk of material is decidedly advantageous in that the placement of lingual arches in occlusions of very close bite is permitted,

Fig. 3.—Above: Accessory labial arch constructed for opening spaces. Below: Simplified form of expansion arch.

this enabling the operator to open the bite by the application of both lingual and labial arches.

Arch wires of very small gage are by no means safe in the hands of the beginner unless he is carefully guided, but their scientific application will prove efficient with absolute control of anchorage if the operator will but take into consideration the action of the rebound or reactive forces and make those forces work for him instead of permitting them to work against him. Various combinations of group anchorage can be worked out in which one pits one group movement against another group, having all teeth move, through the expenditure of force, toward positions of normality. I present the following principles in regard to the light resilient arch wire. It permits of three principal classifications of force control.

1. Simple spring pressure or the elasticity of flection applied to one or several teeth simultaneously, the reactive forces pitted against a group of teeth whose positions are nearly normal.

2. The same pressure applied to one or several teeth, the reactive forces pitted so that they act as active rebound forces to move what are virtually the anchor teeth to normal positions.

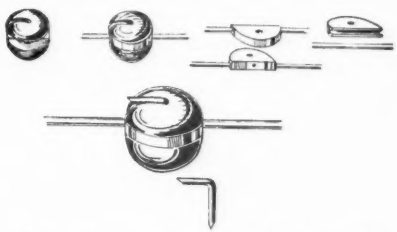

Fig. 4.—Individual parts of the Griffin lock: 1. Seat. 2. Seat with block engaged. 3. Block with arch wire. 4. Point drilled for solder in rear wall of block. 5. Block made in open form to be attached additionally to arch wire. 6. Assembled lock with arch wire and spike. 7. Spike.

3. The elasticity of torsion in which the resilient arch transmits to certain teeth through its substance the rebound forces for the application of root control.

4. The combination of the foregoing applications.

Anchorage, in its true sense, does not exist in orthodontia. Millions of cells are always disturbed in any application of force, and it is the problem of the orthodontist to so assemble the forces that the resultant effects will produce a normal structure in development as he visualizes his case in the completed stage.

Aside from the arch wire itself, the remaining vital part of the appliance is necessarily some type of locking device,

in order that the pressure, having been made during the adjustment, in degree and direction as desired to produce the proper stresses, may be maintained under the tension set to produce a continuous action until the energy of the force is spent. It is necessary, if the maximum efficiency is to be obtained in a practical way with small gage wires, that such a locking device must possess several mechanical features. I worked for a considerable time with various locking devices, including two years with the Robinson lock as described by Dewey,[2]

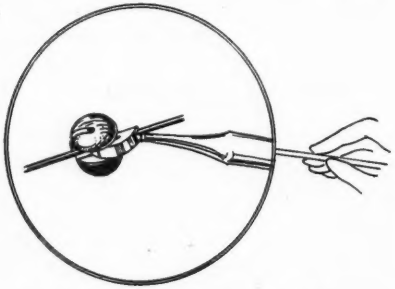

Fig. 5.—Pressing the block into position for locking by a penlike grasp of an instrument against it.

but was compelled to abandon its use because of serious defects. There are two important virtues which it possesses, and these I have retained in the evolved lock herewith presented, which I have now used for several years. The first principle permits the arch wire to pass through the center of the entire attachment *en masse*. The arch wire is thus alined at right angles to the long axis of the tooth and the force is transmitted equally from the center of mass of the attachment. This center of alinement and force emanation is important for the proper adjustment of pressure. The second principle is that the attachment involves the application of elasticity of torsion for root control in the bodily movement of teeth. However, in the following respects, the evolved lock as used in my practice today has been entirely changed.

1. The lock is spherical in shape and is so constructed as to minimize the elevation of the block.

2. A fastening arrangement is provided in the form of a miniature spike for locking the attachment. The spike head rests in a recess in the seat portion

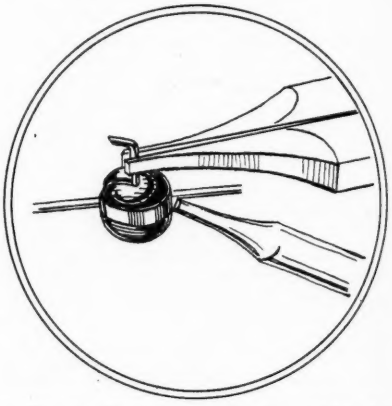

Fig. 6.—Placing the spike in position for setting the pressure.

and, when locked, the spike does not protrude from the surface of the spherical block portion, this eliminating any rough, sharp, or irregular part that might cause irritation. Also, it cannot rotate while in position.

3. The spike head consists of a portion which is at right angles to the shaft and the under side of which is beveled to insure accessibility and easy removal by the specially designed hook instrument for that purpose.

4. The lock holds very securely and it is practically impossible for it to be-

2. Dewey, Martin: Practical Orthodontia, Ed. 4, St. Louis: C. V. Mosby Company, 1919.

come loosened until this is done by the operator.

5. The attachment permits of locking and unlocking with ease by using the instruments designed for that purpose.

6. The block portion offers positive security to the arch wire through the medium of a gnat's eye of solder in the groove at the back of the block.

7. The block portion is also made in open form on the posterior side to permit readily attaching additional blocks to the arch wire at any time without reconstructing the arch.

8. A flat clasp or finishing attachment of a different type is used to assist in maintaining proper alinement of the arches after development has been accomplished and root movement has been completed.

9. The alloy used in the attachments is of precious metals and is white, giving harmony from an esthetic standpoint with the remainder of the appliance. It is of sufficient hardness to be manipulated easily, and without danger of distortion to the lock.

10. Precision in manufacture insures uniformity and interchangeability of parts, and repairs and replacements are consequently simplified.

All work of constructing and assembling the appliance is done directly in the mouth. All soldering is done by the free hand method.

The bands are made first and are placed on their respective teeth for determining the positions of the stabilizing wires which connect such bands for the teeth that may be designated to provide group anchorage. The attachments, alinement hooks, intermaxillary hooks, etc., are next soldered in proper alinement for the arch wires. All bands are next cemented, the cemented portion thus constituting the framework to support the arches. The arches are made directly by measuring the attachment position with the eye and are gradually designed and made to conform to the counterparts of the attachments which are soldered to the bands. On completion of the construction, the arch is ren-

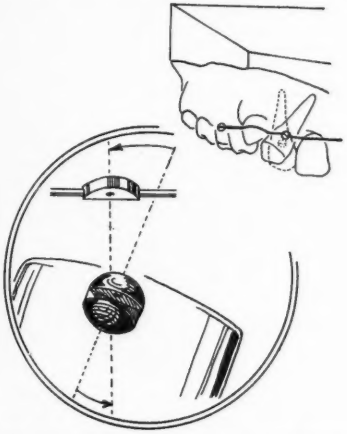

Fig. 7.—Adjustment to move a root distally and the crown mesially.

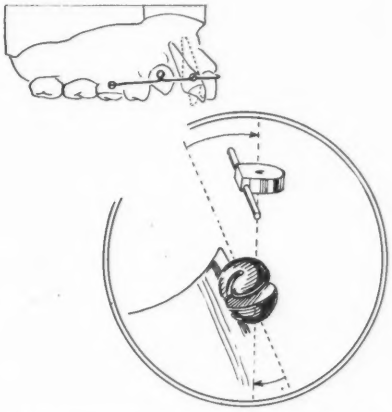

Fig. 8.—Adjustment to move a root labially and the crown lingually (elasticity of torsion).

dered a functioning one by the adjustment of pressure and the locking of the respective attachments under the pressure as desired. There is no occasion for investing any part of the appliance either in the original construction or in making repairs. The alloy wire requires no heat treatment for tempering or annealing. The amount of heat required in soldering the block gives it a tenacity that permits of repeated bending and rebending so that often the loops are completely opened or closed by adjustments before breaking. Also, the proper elasticity of the arches for splendid spring action is maintained. The stabilizing wires are eliminated as soon as the case has developed into a simpler type, when much less anchorage is needed and the reactive forces can be safely sustained by two terminal anchor teeth.

I have found it particularly advantageous to increase the gage of the arches in the latter stages of treatment and to discard the fixed attachments, at which time a general pressing action is effected in conjunction with the use of the clasp or finishing attachment.

The resilient arch is so designed as to exert pressure on the lingual surfaces of the teeth and may be used at any juncture during treatment in combination with an accessory labial arch to meet varying requirements. This combination of labial and lingual resilient arches readily admits the application of the so-called "ironing out" principle on the malposed teeth, delivering the pressures bilaterally on these teeth without the necessity of using many bands. The resilient arch is in itself an elastic, functioning arch at every point in its application. Any portion and any number of attachments within one portion of the arch may be used as occasion demands for the anchorage groups; while at any point in the remaining portion of the arch, the resiliency offers a ready means of adjusting a spring force on the teeth to be moved. There are no auxiliary springs to be added or detached.

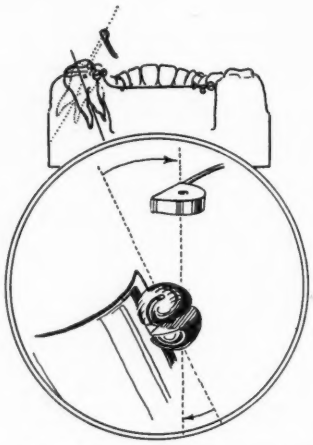

Fig. 9.—Adjustment to move a root buccally and the crown lingually (elasticity of torsion).

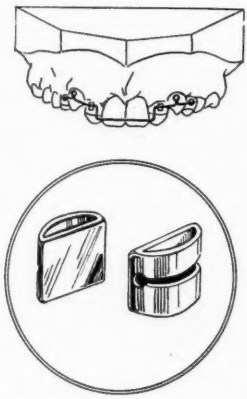

Fig. 10.—Typical application of the clasp attachment with labial arch after root movement has been accomplished. Inset: Enlarged view of clasp attachment.

In the application of the light resilient arch, it is possible to apply a pressure so gentle that the patient is unaware of it, or to accomplish tooth movement so rapidly that soreness and irritation may be produced. Also, the arch can be left off or put on at different periods during treatment. The elasticity of flection as applied to an entire arch of teeth or the elasticity of torsion as applied to one or

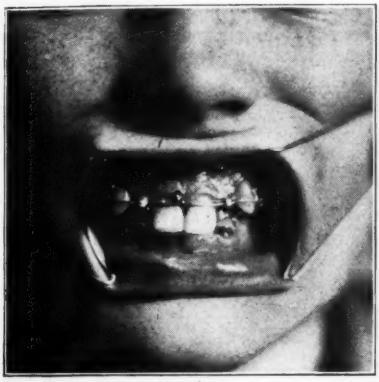

Fig. 11.—Typical application of labial accessory arch with locks for bodily root movement.

several teeth in bodily root movement is exhausted after about one month, when another adjustment is given; or rest periods may intervene.

Individual tooth movement such as rotation or adjustment for slight irregularities in finishing work can be adjusted more frequently to advantage. It is beneficial, in addition, to give the tissues a complete resting period at intervals, as recommended by Dr. Mershon.[3] The teeth may then adapt themselves accord-

3. Mershon, J. V.: Removable Lingual Arch Appliance, Proc. First Internat. Orthodon. Cong. Physiology and Mechanics in Orthodontia, Dent. Cosmos, 64: 1197 (Nov.) 1922.

Fig. 12.—Typical application of lingual arch.

ing to Nature's plan. The occlusal relationship can be established in the position in which they will finally stay without the use of any retainer. The appliance is gradually simplified and eliminated, thus acting as its own retainer, while the teeth, more and more, come into complete and independent functioning units with no mechanical support whatever.

Fig. 13.—Typical application of labial arch with clasp attachment.

This enables the operator to study the production of a final balance, with Nature providing her own articulator, and any remaining disharmonies at any point throughout the dentition may be noted and the cause rectified before dismissal of the case.

Intermittent pressure has, in the light of investigation, been deemed preferable to continuous pressure. Such pressure, it is claimed, permits of intervening rest periods. This, in my opinion, is very desirable, if a considerable force is delivered at the moment of adjustment, whether it does or does not continue for a considerable time. As stated above, light, even, continuous pressure is most desirable. This type of pressure may be used quite safely without intervening rest periods, which are, however, advantageous in assuring permanency in position after treatment. Strictly speaking, no pressure as applied in orthodontics can be truly continuous.

The manipulation of the light resilient arch is not exceedingly exacting. The arch used in conjunction with the attachment as shown presents no rigid or definite form, to be changed by an exacting adjustment to a slightly different form as desired by the operator. When there is resiliency at every point in the arch, it naturally lends itself to adaptation to the malocclusion as it exists. Then when adjustments are made to bring it nearer and nearer to the normal form, there is no sudden, exacting or rigidly yielding and changed conformation of the arch thrust on the teeth that are to be moved. The adjustment as measured at the attachment varies from 1 to 3 mm. as the seat rests passive out of the block. The block is sprung into position for locking by a penlike grasp of an instrument against it, a few ounces of pressure being registered from the moment of the initial setting and gradually decreasing until exhausted. The teeth move to new positions much in accordance with the adjustment, but the natural forces are also co-workers with the resultant forces of the adjustment, since they are allowed to come into play and to assist in the adaptation to a new form. The mechanical advantage of the incline plane relationship is thus utilized as a guiding influence.

The adjustments may be made with the arch wires unlocked and in the passive condition, and consequently, when any

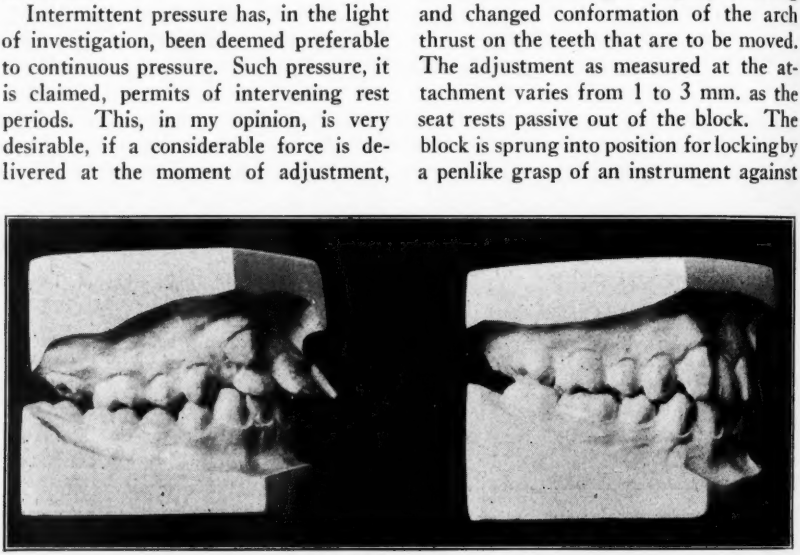

Fig. 14.—Pronounced bone development of the premaxillary region in case with closed bite.

pressure is to be applied, the reactive forces (for all forces are equally reactive and opposite) can be tested at any attachment before it is locked to place and the resultant effects of the new adjustment may be visualized in the operator's mind. The compensatory torsional reactions to be taken into account are simplified by comparatively few attachment points between the arch terminals, and the round wire also makes them less complicated because, as Dr. McCoy[4] states, "A round wire for the working portion is better adapted than one which is rectangular for reasons which are obvious to anyone who has studied the comparative uniformity of force control of the two forms."

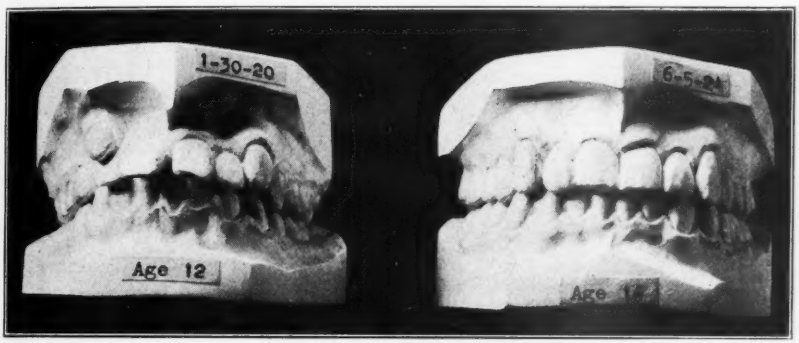

Fig. 15.—Front view of casts shown in Figure 14.

It is commonly believed by many operators today that any immovable or fixed attachment to a tooth under treatment cannot help but produce excessive stimulation and thereby impair function. Those who believe this probably do not take into consideration the rigidity of the arch carrying the fixed attachment and also the distance between the points of fixation on the teeth to be moved. In experiments with various gages of light resilient arches to determine the comparative forces applied, I have noticed that, as the size of the wire increases, the force is also increased, out of proportion to the size of the wire. This deduction has likewise been explained by Frederick L. Stanton, Mr. Batson of the National Physical Laboratory and possibly others. The amount of force required to elongate a straight wire will vary as the square of the diameter, according to Hooke's Law. In other words, if we double the gage of the wire, the force is increased four times. Also, if a straight wire is imbedded solidly at one end and the opposite end is deflected laterally, the force will vary to the fourth power, or sixteen times as much force would be exerted if the gage of the wire is doubled. This ratio would likewise hold if the straight wire were fastened at both ends and a force between the terminals deflected the wire laterally. Again, in helical coils, closely wound, as the gage of the wire is doubled, it requires approximately sixteen times the force to lengthen the coil a given distance.

With orthodontic appliances, the arch wires or finger springs generally present

4. McCoy, J. D.: Applied Orthodontia, Chap. 13.

a considerable curvature between the terminals, of variable degrees and forms; which affects the law of variation of forces exerted from a mechanical standpoint. My experiments with the arch looped and used in conjunction with a fixed attachment as described shows that the force increases, approximately, to the cube of the diameter of the wire, or eight times if the gage of the wire is doubled. Also, it is well to consider the rapidly increased effect of rigidity in the arch produced by attaching several teeth under a fixed attachment at one time.

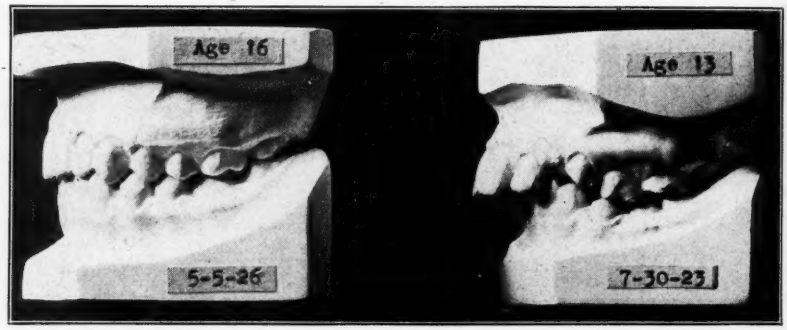

Fig. 16.—Bone development of the lateral alveolar process in case presenting lack of vertical development, exaggerated curve of Spee, and partially impacted bicuspids.

It is apparent that the coefficient of elasticity of the particular alloy of wire used, which may be altered by the status of its molecular arrangement under any heat treatment, or the constantly changing molecular status under manipulation and usage will likewise be a determining factor as to the amount of force actually delivered to the teeth under attachment from a physical standpoint.

It is my recommendation that the amount of pressure delivered to the tooth, from the initial moment of application, be limited to a few ounces of pressure. In reply to those operators who feel that a risk is involved in the application of the so-called fixed attachments for the bodily movement of teeth, with attendant danger of root absorption by such treatment, I wish to state that several years' experience with the technic as described and with attendant radiographic check-up in my practice has led to this conclusion: Such comparative risk should not be based upon the belief that excessive stimulation is produced by fixed attachments between the banded teeth and the arch, but that the important consideration is the degree of rigidity offered by the arch itself, whether the force applied through attachment to it is excessive, and the extent to which the teeth under attachment, during movement, are interfered with in their functional activity.

Such interference may result either from rigidity or from spring action which is improperly applied. The appliance should minimize both immobility and mobility, as far as is consistent with efficiency.

Experience in my practice has shown that a comparison of the resultant effect of tooth movement bodily through the

process with that of various other movements produced by mechanical stimuli during treatment does *not* give evidence that the bodily movement involves a greater risk and one attended by unfavorable sequelae. In fact, there are various other factors from a biologic and physiologic standpoint which do not conform to physical laws and which may produce varying reactions to the pressure delivered on the teeth to be moved. From a mechanical standpoint, I believe that a minimum risk is involved from any type of appliance:

occlusion, before general development has been attained, to permit readily moving individual teeth to position with minimum pressure and interference.

The use of this arch presents a unified technic for a wide range of conditions which arise in the daily practice of orthodontics. Cases of various types, all of which are severe conditions, have been selected from my practice to illustrate the versatility of its application. The design of appliance construction is varied to meet different requirements and the design changes as conditions change.

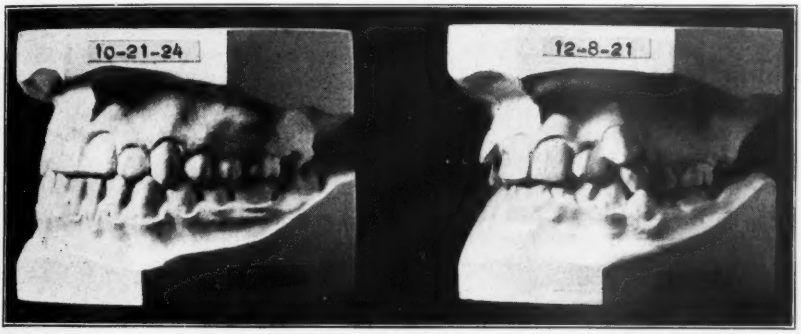

Fig. 17.—Pronounced development of both maxillary and mandibular arches.

1. If the arch, in root movement particularly, gives resilient support to the teeth, without spring action, which accentuates traumatic occlusion during treatment.
2. If the initial force delivered to the tooth is of a few ounces only.
3. If the force is gradually spent over a considerable period of time between adjustments.
4. If the tone of the investing tissues is noted and irritation is prevented.
5. If the operator avoids pressure of one root against an approximating root in attempting to move an impacted or crowded tooth prematurely to the line of

Truly, one appliance will not efficiently treat all types of cases. We have repeatedly heard that there is no universal appliance. It is my experience that the same fundamental physiologic and mechanical principles can be satisfactorily applied to stimulate cellular activity in all cases. It seems to me a difficult procedure in practice to attain the height of efficiency with radically different appliances. The gage of the arch wires may vary to accommodate tissue reactions, but variations in types of arch wires or attachments seem unnecessary. If the fundamental principles of tooth movement are to be accepted along bio-

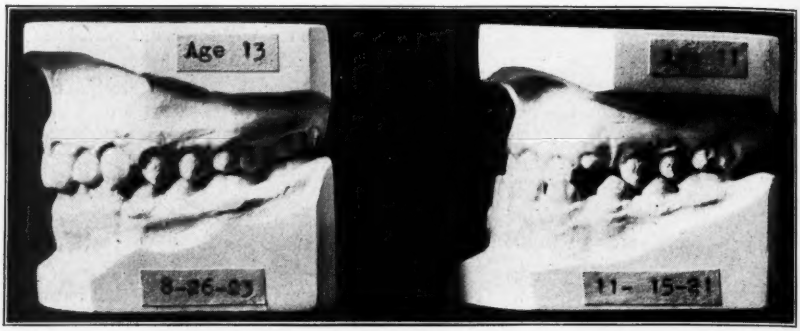

Fig. 18.—Reduction in mesiodistal lengths of mandibular lateral processes in case presenting wide spaces between bicuspids and cuspids, bilaterally.

logic lines and in accordance with physiologic laws; if stimulation by mechanical means without irritation and impairment of function is desirable; if, in the final analysis, Nature truly corrects the abnormality in response to our aid, and if the truly individual normal of the masticatory apparatus for any individual is the result of growth and development, why should we not resort to a standardized form of mechanical stimulation to induce cellular activity in the treatment of various types of malocclusion?

Whether the case calls for an increase or a decrease of cellular mass, mechanical stimulation will result in an absorption or a deposition, according to the direction of the stress applied, and the tissue changes about the individual teeth should always be within physiologic range. I wish to emphasize that this comparatively unified treatment applies to the method of inducing cellular activity by mechanical stimulation only. The various other vital considerations in orthodontics are not here considered.

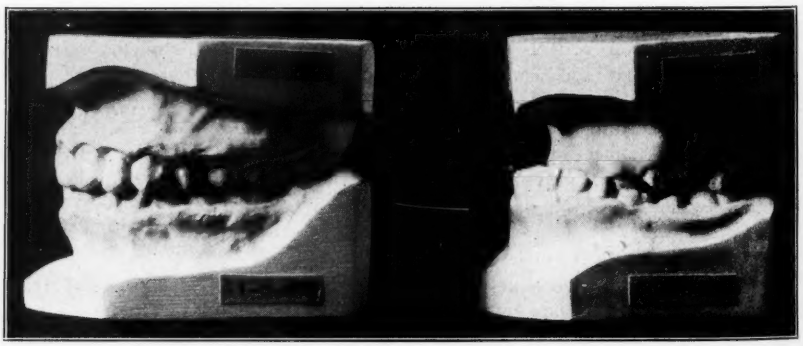

Fig. 19.—Pronounced development of the maxilla in case presenting complete impaction of cuspids and partial impaction of second bicuspids, bilaterally.

Fig. 20.—Extensive development of the mandible in case presenting impacted first bicuspids.

DISCUSSION

O. W. Brandhorst, St. Louis, Mo.: Dealing with appliances from a technical standpoint always requires a thorough knowledge of the apparatus. I do not believe that the appliance here described is universally used. I shall limit my remarks to general principles, and shall make no attempt to discuss the merits of the locking device further than to say that I regret that it is of such construction as to require special instruments for its adjustment. The use of small gage wire for moving teeth is nothing new. Its application as here outlined is not at all common. We can all subscribe to the advisability of securing sufficient anchorage, even by combining several teeth. We are treading on dangerous ground when we apply sufficient force to move all the teeth at once. It is here that we must be cautious and must know what the reaction is to be. I am sure Dr. Griffin can enlighten us in the method of making changes and tell us what the effects of these changes will be. We understand that when we combine the resistance of a number of teeth in order to move the molars, we are really changing the anchorage to the combined teeth. We might speak of the teeth to be moved as the point of attack and the resistance utilized as anchorage. It is all comparative and the result depends on keeping a sufficient resistance balance on the anchorage side of the scale. Reciprocal forces in anchorage are ideal, but unfortunately it

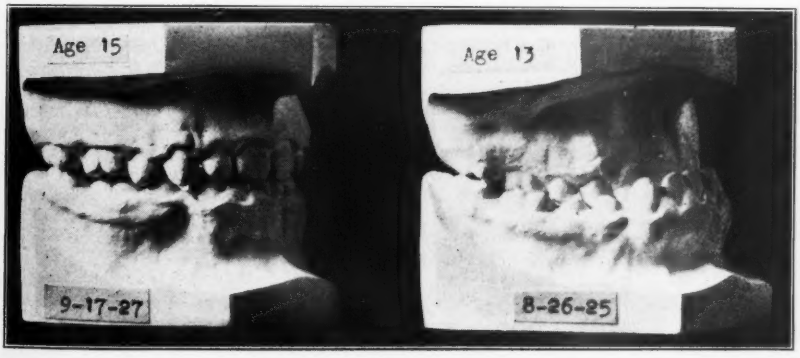

Fig. 21.—Extensive reduction of the anterior segment of the alveolar process of the mandible in case presenting congenitally missing upper first bicuspids, after extraction of lower first bicuspids. (Case not completed.)

is difficult to apply a force that will act equally at both ends of the power arm, because it is hard to find an instance in which the resistance is exactly equal at both ends. That the tone of the tissues must be watched is good advice, but how are we to acquire the necessary knowledge except through experience? Fortunately, as Dr. Griffen says, there is quite a range between sufficient stimulation and overstimulation. This probably saves many of us. I am interested in knowing just how to determine 2 ounces of pressure in an appliance. Again, will it take 2 ounces of pressure thirty days to expend itself? What is the estimated rest period under such a plan? Probably one of the greatest advantages of the small wire is the minimum bulk. If the appliance does its work, well and good; but there are many mouths in which the use of small gage wires would be contraindicated. The smaller the gage, the less the pressure or force required to bend it out of shape or position. With rough usage and hard wear, a larger gage would, of course, be better. In selecting the heavier wire, it would be well to remember Hooks' law; namely, that the pressure will vary directly as the square of the diameter of the wire. One of the great assets of the appliance as presented here today is the elimination of many bands for the teeth. Dr. Griffin seems to have hit upon an explanation for root absorption in his statement that it occurs in only those cases in which functional activity has been interfered with. Perhaps this will shed some light on our problems. I was glad to hear him say that he does not believe one appliance will cure all our orthodontic ills.

Dr. Griffin (closing): Taking up the points which seem to be in question; in regard to the problems of anchorage for resistance: It is not possible to assemble an appliance and start working in such a manner that the movement of certain teeth in group anchorage would be equal to movement of teeth which we are primarily treating in the case. I would simply bring out the point that, as long as all actions are equal and opposite, it is economy, in the working of our appliance, to apply the opposite forces which are against the anchor teeth, and let those forces be working to move the so-called anchor teeth nearer the position of normal instead of letting that be entirely an inactive force. We can stop using it any time in the treatment, but in using the forces that way, we may bring a group of teeth which are virtually anchor teeth to normal position at almost the same rate in which we are treating the teeth in opposite segments. Concerning advice to the inexperienced, my first advice would be not to make adjustments too frequently. My first consideration in treatment is the possibility of doing damage, even with small gage wires. When we consider that one of these small arches will move the teeth buccally with a very slight expenditure of force, it can be proved easily that only the very lightest pressure is needed. Next, concerning how to determine 2 ounces of pressure: It would be very difficult to estimate with accuracy 2 ounces of pressure upon a given tooth. The final amount of pressure exerted upon a tooth under treatment will depend on many variables. A long list of conditions could be given which make a variation in the final

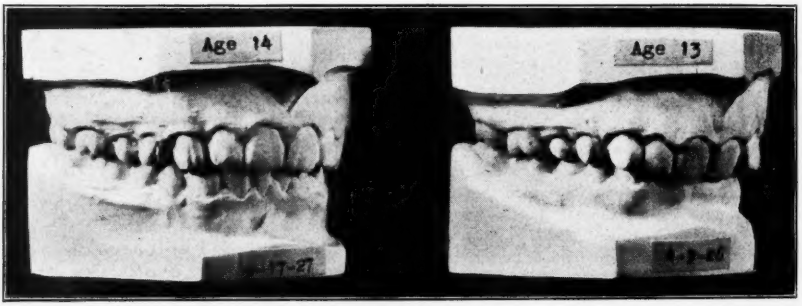

Fig. 22.—Vertical development accomplished in one and one-half years. (Case not completed.)

amount of pressure which will be exerted on the tooth when it is moved. However, simple experiments which I have made with the technic that I use show that it is only necessary to apply a weight to measure the spring force along the arch that we are using. By experiment with the pressure as I use it, if I open a loop of an 0.018 inch wire or 25 gage wire 4 mm., I will produce or require a pressure of 8 ounces, approximately. If I open a loop of 0.036 inch wire, just twice the diameter, only a fraction of a millimeter, I produce a pressure of 8 ounces, approximately. You can readily see that as we increase the gage of the wire, we produce a condition which makes the adjustment more exacting. Taking that as the basis, if we wish to use 8 ounces of pressure in our adjustment, would it not be much easier to adjust within a range of 4 mm. than to have a range of a fraction of a millimeter? If we wish to use anywhere from 2 to 4 ounces of pressure, we simply open the loop a shorter distance, and we still have a range of action which makes our adjustment simple in comparison. That is the advantage of the small gage wire. We are able to apply a light pressure over a considerable range of action on the teeth themselves, and also have a considerable distance in any adjustment of pressure we make. We are not bound down to fine points of adjustment. It seems to me that the trend in applying mechanical forces upon the teeth should be to get away from definite appliances. We think of appliances as a definite form and give them a certain name. That is necessary for a certain conception in our mind of what we are using. But back of that, we are using mechanical forces to stimulate cellular activity of the teeth and the adjacent tissues. The main principle is that we apply universally accepted mechanical laws to the fundamental principles of tooth movement. If we can agree on these, the appliance will, more and more, be less definite in form, but will merely be a means of mechanical stimulation, and we will constantly change the so-called appliance all the way through the treatment to meet the conditions of the tissues themselves, so that if we are asked at any time during the treatment of our cases what appliance we are using, we will be unable to say. We will show a certain mechanical application in the mouth to produce a certain stimulation needed by that case at that particular time, until it is finally finished.

WHAT TEETH SHOULD BE EXTRACTED: FROM THE EXPERIENCE OF THE ORAL SURGEON*

By WILLIAM H. G. LOGAN, M. D., D. D. S., Chicago, Ill.

IN view of the fact that there still seems to be much confusion as to what teeth should be extracted, it is with some hesitation that I have consented to present an analysis of the problem as it now appears to me. For the purpose of simplicity, I shall present what I believe to be some fundamental rules for the rational consideration of the different types of cases. The decision as to what teeth should be extracted is often not one to be answered in its finality by the oral surgeon, the root canal therapist or the research pathologist, but rather one that requires the mature judgment that can be best arrived at through long experience and frequent consultation among members of the aforementioned groups plus the physician who is being held accountable for the physical care of the patient. For the purpose of brevity and in order that my

*Read at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

*The papers of Drs. Logan, Blayney and Hatton were presented as a symposium.

views on this subject may be more readily understood, I shall arbitrarily classify teeth into ten groups, as follows:

1. *Teeth embedded in normal structures and not held to be the cause of disease or unfavorably influencing any pathologic condition, and which in the opinion of the consultant will never erupt.*

These teeth need not be removed simply because the tooth is in an abnormal position. An opinion is expressed favoring the retention of such a tooth in certain cases in spite of the fact that many practitioners believe that all such teeth should be removed. The contention of some that embedded teeth, in every instance, have their investment membranes invaded by pathogenic bacteria that are acting as a menace to the health of the patient is not accepted by many authorities. Therefore, when the patient's general health is good and the investment structures are held to be normal, we advise that such an embedded tooth need not be removed simply because of its abnormal position. The work of Gottlieb and Orbán, which has been corroborated by numerous other histologists and is now generally accepted, has shown that, in unerupted teeth, there is a definite attachment of the enamel cuticle to the surrounding tissues and that there is no pathologic space between the unerupted tooth and any part of its investment tissues that might invite the accumulation of fluid or other material that would encourage the localization of infective organisms. From their observations, it is evident that there is no more reason for suspecting an unerupted tooth of harboring infection that there is of suspecting submerged tissues of any other type elsewhere in the body.

2. *Teeth embedded in roentgenographically normal structures but held to be accountable for or influencing certain neurologic phenomena.*

These teeth can wisely be removed, provided the physician who has charge of the case is in agreement that no other factor is suspected to be the causative influence and favors the removal of the embedded tooth. Since the operation of removal of such teeth is accompanied by considerable systemic shock, it is considered of utmost importance in dealing with patients suffering from serious neuroses that the advice of the physician in charge be secured before causing or even permitting a patient to undergo such surgical treatment. Otherwise, a serious injury may result from the distress incident to the removal of the embedded teeth. Conversely, one must consider the fact that embedded teeth may be exerting the effort of eruption and normal absorption is not occurring. This condition results in pathologic pressure in the local field that may produce neuralgia or neuroses of a serious character. Therefore, in spite of the fact that a roentgenogram shows the tooth embedded in apparently normal structures, such teeth as are creating neurologic phenomena do require removal. But this must always be accomplished at a suitable time if one is to avoid unfortunate end results.

3. *Embedded teeth whose eruption is being impeded by contact with the roots of adjacent teeth.*

If an embedded tooth is having its eruption delayed by coming into contact with the root of another tooth, one is forced to decide first whether or not the embedded tooth has caused absorption of the cementum and dentin of the root with which it is in contact to a degree that the pulp is involved; for if this has

occurred, such a tooth, as a rule, is hopelessly injured. But when only the cementum is involved, without excessive absorption of the dentin, many of these injuries will undergo repair if the embedded tooth in question is removed. With few exceptions, when the cementum of a tooth in the middle or apical third is absorbed as the result of pressure, to a degree that it is materially weakened and in the opinion of the consultant will never become useful, extraction is indicated. If the embedded tooth can conveniently be brought to occupy the position of the one thus extracted, such a procedure is often indicated; but if the embedded tooth cannot be made to erupt to some useful purpose, it is wise to extract it at the time of removal of the tooth in which it has caused root absorption. If an embedded tooth is erupting in the direction of the root or roots of teeth, it is frequently considered good judgment to remove such a tooth to avoid the root destruction just referred to.

4. *Embedded teeth, the surrounding structures of which are held to be the seat of pathologic changes.*

If the structures surrounding an embedded tooth are once the seat of infective inflammation, the rule should be to remove the tooth; for usually when infection once invades the soft structures about a tooth, they do not permanently recover except after removal of the tooth. It is understood that the tooth under discussion is one that will not erupt.

5. *Embedded root fragments with or without a communicating fistula.*

Embedded root fragments with or without communicating fistulas can serve no useful purpose, and although it has been the experience of many that occasionally a small root fragment may apparently heal in with what appears to be normal surrounding structure, the safer course to pursue is to clear the jaws of such roots for the reason that they may at any time become the seats of infections which may produce general metastatic disease or result in the loss of a considerable portion of the bone through either necrosis or osteomyelitis.

6. *Teeth containing putrescent or infected pulps or with pulps involved with total nonseptic pulpitis, and the apical periodontal membrane vital.*

We have now reached the point in our discussion of the indications for the extraction of teeth where a marked variation of opinion is perhaps justifiable. But since I am called on to express a definite opinion, an effort will be made to do so. I believe that a tooth having root canals that are accessible to proper treatment and subsequent filling need not be extracted simply because the pulp is putrescent, infected or involved with total nonseptic pulpitis, provided the apical periodontal membrane is vital. The foregoing statement should be qualified, perhaps, with one condition, that such a course of treatment is not indicated if the patient is suffering from any systemic disease which is now held to be accountable to focal infections and no other localized infective areas are present in the body.

7. *Pulpless teeth containing satisfactory root canal fillings and showing roentgenographic evidence of destruction of the periodontal membrane at their apices, this infective process held to be chronic.*

In the cases of pulpless teeth containing apparently good root canal fillings and showing roentgenographic evidence of destruction of the periodontal membrane at their apices, one is called on to

decide between extraction, root amputation or leaving in the part that which will perpetuate the chronic infection; for I do not believe that with our present technic any one will contend that new cementum will uniformly be laid down, with the reattachment of an apical periodontal membrane, in the presence of chronic infection. Therefore, if we cannot eradicate the infection and leave the tooth in position, removal of the tooth is indicated if we hold it to be our duty to protect the patient from the end results that are often attendant on chronic localized infections.

8. *Pulpless teeth containing satisfactory root canal fillings and whose periapical tissues are roentgenographically normal.*

In patients free from those diseases that are now held to be caused by focal infection, a pulpless tooth, as herein described, need not be extracted; neither should such a tooth be condemned in patients suffering from such diseases as long as there are known areas of localized infection in any other part of the body. To state it another way: In the case of a pulpless tooth containing a good root canal filling and supported by a normal investment membrane after thorough examination, the overlying soft tissues are found to be negative, and the question is asked: "Why should any one advise the removal of pulpless teeth that do not show evidence of infection as long as we have definite knowledge of such infective processes in other parts of the body?" But our final decision on this pulpless tooth must vary from the foregoing when the patient *is* suffering from those serious diseases that are influenced or caused by focal infection, and the most careful search of the system does not reveal any localized area and it is the opinion of the medical advisor in charge that the condition cannot be brought under control as long as any possible localized infection remains. When confronted by such a situation, the dental consultant, much as he may regret to do so, is often obliged to approve or request the removal of the pulpless tooth that contains satisfactory root canal fillings, although the periapical tissues are roentgenographically normal. This decision is based upon the possibility of such teeth containing in their periapical tissues pathogenic organisms accountable for the serious systemic involvement from which the patient is suffering. The patient should be advised that his general health may not be benefited by the removal of these negative pulpless teeth, but if his best interests are to be served, all questionable areas of infection must be eradicated. Examples of the diseases referred to that would, under these conditions, justify the request for the removal of such pulpless teeth are ulcers of the gastro-intestinal tract, iritis, keratitis, cardiovascular disease, goiter, myositis, arthritis, neuritis and pronounced anemia.

9. *Teeth affected by pyorrhea: stages involving: (a) the gingival third; (b) the middle third; (c) the apical third.*

Teeth involved with pyorrhea need not be extracted simply because of such an invasion provided the infective process can be brought under control and a condition of health maintained. When this invasion has not passed the gingival third, such an arrest is, as a rule, readily obtained. As the involvement proceeds into the middle third, the prognosis passes from favorable to doubtful, and the general rule is to extract teeth when the apical third is involved, provided the destruction has spread laterally for some considerable distance. One is also

justified in condemning multiple-rooted teeth when the attachment at the bifurcation has been hopelessly destroyed. The frequency with which mild anemia, neuritis and myositis are associated with pyorrhea is worthy of record.

10. *Partially erupted mandibular third molars involved with a minor or grave infection.*

When the soft structures overlying the crown of a partially erupted third molar (or any other tooth) undergo infective inflammatory change, prompt treatment should be instituted to bring the condition under control, and extraction is contraindicated while such an infective process exists. In many instances, serious bone involvement follows the extraction of a tooth when its coronal investment membrane is the seat of acute infection. To avoid a wide invasion of the infection without extracting the tooth, one is not always required to resort either to lancing or to the excision of the overlying flap. Satisfactory results can usually be obtained by forcible irrigation with a very warm sterile solution until all food particles or retained pus have been removed. Then the field should be dried and flooded with a 5 per cent solution of iodin. It is well to irrigate twice daily in an advanced case, but, as a rule, irrigation once daily will insure a satisfactory end result within two to five days. In the more serious group of the minor infections of this field, it is better practice to remove a button of the restricting flap and proceed with the irrigation as outlined. Some trismus accompanies such infections, and the practice of forcibly separating the jaws to extract such a tooth is not considered good judgment. When the muscles of mastication have been so invaded with an inflammatory process as to materially restrict the movement of the mandible, it is evident that the infection has spread far beyond the confines of the tooth in question. To extract the tooth at this time would not relieve the condition so quickly and safely as would the treating of the infective process symptomatically and awaiting the termination of the acute inflammatory process. If there is an indication for the extraction of this tooth, a delay of from two to four weeks is advised to allow the field to be freed from the acute bacterial invasion. This advice is given because cases of osteomyelitis and necrosis frequently follow the extraction of teeth during the period of such an acute infection.

Before concluding the discussion of "What Teeth Should Be Extracted," it is deemed imperative that we allude specifically to the indications and contraindications for the removal of hopelessly diseased teeth that are involved with serious acute infections, with special reference to those extensive infections with marked boardlike cellulitis so often occurring at and below the angle of the mandible and complicated with almost complete ankylosis, a temperature between 102 and 104 F. and a pulse from 120 to 140. The foregoing picture definitely contraindicates the extraction of teeth at the time the findings are as described without regard to whether or not the teeth are hopelessly diseased. Here, hot moist dressings should be applied and watchful expectancy should be followed until the pus has localized. When this stage is reached, the pus should be promptly drained and its continued evacuation provided for by the maintenance of a guttapercha rubber drain. When the localization is at or far below the angle or lower border of the mandible, it should not be expected, as a rule, that the case can be success-

fully treated by incisions within the mouth. External incision, which can usually be made without leaving objectionable scars, is the only safe course to pursue. In many instances, a sudden drop in the temperature that is not accompanied by a like recession in the pulse rate often indicates localization of pus. Prompt investigation is always indicated when such a change occurs. Many of these grave infections of dental origin do not require external incision if the physician in charge will carefully observe his case during the early days; for, in the majority of cases, the localization of pus on the buccal surface of the alveolar process and the body of the bone precedes the serious infective invasion of the tissues at or below the lower border of the mandible. Early palpation of the underlying periosteum must be a routine practice, and although one is not to make unnecessary intraoral incisions through the periosteum, he should, in case of doubt, either incise or aspirate, and when the periosteum is not in contact with the bone, the exploratory opening within the mouth should be enlarged and either a rubber or oiled gauze drain should be placed in contact with the bone. This should be replaced daily in like position after irrigation, as long as the clinical evidence of pus is present. Special caution is urged against incising infected tissues over the buccal and the labial aspects of the ten upper anterior teeth and the upper lip until the pus is localized because fatalities from cavernous sinus thrombosis have followed such an unfortunate practice. This is held to occur as the direct result of the venous drainage from the infected area, by which the incised veins aspirate the causative organisms and carry them direct to the cavernous sinus. It would seem that there should be a more uniform agreement in the management of all serious acute periodontal infections that have invaded the overlying soft structures with the development of extensive cellulitis by making it an invariable rule not to extract such teeth until a considerable time has elapsed after complete cessation of all infective symptoms in the fields, local and remote, from the teeth and their immediate supporting structures. If the members of the dental profession as a group would more promptly drain all subperiosteal abscesses and discontinue the extraction of teeth during the acute infective stage, except when this infection is confined to the immediate vicinity of the apex of the tooth, lives would be saved and many destructive processes of the bones of the jaws would be thereby avoided.

WHAT TEETH SHOULD BE EXTRACTED: A REPORT BASED UPON FURTHER STUDIES OF ROOT-CANAL THERAPY*

By J. R. BLAYNEY, B. S., D. D. S., Chicago, Ill.

ROOT canal therapeutics has been called the "graveyard" of dentistry. Probably no other single division of clinical dentistry has had such a checkered career and still occupies such an important position in dental discussions. It is believed that Edward Hudson was the first to practice pulp removal, in 1809, filling the root canals of anterior teeth to the apex with gold. It is also known that attempts were made by Bourdet as early as 1757.[1] The use of almost every known drug as a medicament has been advocated, and filling materials from gold foil down through hickory and orangewood points to cotton saturated with creosote have been popular; not to mention the practice of pulp mummification. Dentists of this early period were firmly of the opinion that they could successfully place the filling material of their choice to the root ends.

It was not until the development of the roentgen-ray in 1895, and its application to dentistry by Price, Kells, Van Woert and others, about 1900, that skepticism first began to develop. Dec. 5, 1899, Weston A. Price gave a lecture before the Ohio State Dental Society on "The Roentgen-Ray with Associated Phenomena, and Their Applications in Dentistry,"[2] in which he called attention to incomplete root canal fillings. Again, in 1901, the same writer, addressing the Cleveland Dental Society, indicated the usefulness of the roentgen-ray in root canal procedures.[3] As far as I have been able to ascertain, no one developed a technic for root canal work which was to be guided by the roentgen-ray until 1908, nine years after Price's first description. It remained for M. L. Rhein[4] to advocate a technical procedure supported by roentgenography.

Three years later, William Hunter's address on the "Rôle of Sepsis and Antisepsis in Medicine and the Importance of Oral Sepsis as Its Chief Cause" materially heightened interest in the discussion as to the advisability of pulp removals and root fillings. It was not long until the dental profession was divided into two camps; the more enthusiastic demanding the extraction of all pulpless teeth and some even urging the extraction of those teeth in which the pulps had been exposed by dental caries; the other, or the more conservative practitioners, continuing in their

*Read at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

*From the Department of Therapeutics, University of Illinois, College of Dentistry.

1. Taylor: History of Dentistry, Philadelphia: Lea and Febiger, 1922.

2. Price, W. A.: Dent. Cosmos, 42: 117 (Feb.) 1900.

3. Price, W. A.: Dent. Items Int., 23: 458-472 (June) 1901.

4. Rhein, M. L.: Dent. Items Int., 30: 833-855 (Nov.) 1908.

practice of pulp-canal treatment. Happily, today, the situation has materially changed. There are indeed few operators who will demand the extraction of a tooth with an exposed vital pulp on the ground that it is impossible to treat this condition properly, while, on the other hand, no one would question the advisability of removing many teeth with apical involvement. All branches of dentistry undoubtedly have profited by Hunter's exposition.

CONDITIONS EXISTING TODAY

We may now ask ourselves: What success attends root canal operations today? In analyzing this question, we have made two divisions: (1) the study of previous treatment as exhibited by full mouth roentgenographic examination at the time patients come to the clinic for diagnosis and treatment and (2) the study of those cases which we ourselves have treated.

In 1918, two interesting surveys of the conditions then existing, as supported by roentgenographic evidence, were reported. T. P. Hyatt's[5] report showed conclusively that the better the root canals were filled, the better the results. The cases of good root canal fillings should be interpreted as those cases which received the more careful consideration throughout the entire period of treatment. A. D. Black's[6] report of 600 full mouth roentgenograms representing 6,000 films showed that 50 per cent of these patients had definite areas of bone destruction surrounding root ends. Again, his report states that 45 per cent of all root-filled teeth showed areas of apical involvement, and that of those teeth whose roots were well filled (and treated[7]), only 9 per cent showed destruction; while of those whose canals were poorly filled (and treated[7]) 63 per cent had areas of destruction. The study of 1,000 full mouth roentgenograms, representing 10,000 films, which we have recently made, indicates that the conditions are gradually improving. It is to be remembered that this study was made on 1,000 consecutive adult patients requiring full mouth roentgenograms as they came to the diagnosis clinic for admission to the infirmary for treatment.

This study reveals that 56.3 per cent of these patients had definite areas of apical involvement; a slightly larger percentage than that reported by Dr. Black in 1918, which may be at least partially accounted for through the larger number of cases studied in this report. Again, Black reported that 45 per cent of teeth containing root canal fillings had root end involvement; while the present study shows that, of 2,291 cases of filled roots, representing all types of teeth and all manner of fillings, only 31.6 per cent had such root end changes as could be revealed by roentgenographic examination — a noteworthy improvement over the 45 per cent previously reported. It indicates that, during the ten years intervening between these reports, there has been a gradual increase in the success and therefore the quality of root canal work as performed by those engaged in general practice.

This now brings us to the question: Is it possible to remove the dental pulp and maintain a healthy apical tissue; or, expressed conversely, what percentage of cases develop root end degenerative changes after a known method of treatment? Before giving the tabulations of

5. Hyatt, T. P.: Dent. Items Int., 40: 525 (July) 1918.

6. Black, A. D.: J.A.M.A., 71: 1279 (Oct. 19) 1918.

7. Words in parenthesis are the author's.

TABLE 1.—DATA FROM ONE THOUSAND FULL MOUTH ROENTGENOGRAMS

Total number of patients examined	1,000
Total number of teeth examined	25,645
Average number of teeth per patient	25.6
Total number of teeth having apical involvement	1,308 (5.1%)
Total number of patients having one or more instance of apical involvement	563 (56.3%)
Total number of teeth having root canal fillings	2,291 (8.9%)
Total number of teeth having root canal fillings with apical involvement	724 (31.6%)
Total number of teeth having root canal fillings with normal root ends	1,567 (68.4%)
Total number of teeth having no root canal fillings with apical involvement	584 (2.2%)

TABLE 2.—TYPES OF ROOT CANAL FILLINGS*

Total number of teeth having good root fillings	346 (15.1%)
Number with healthy root ends	299 (86.4%)
Number with diseased root ends	47 (13.6%)
Total number of teeth having overfilled roots	79 (3.4%)
Number with healthy root ends	44 (55.6%)
Number with diseased root ends	35 (44.4%)
Total number of teeth having underfilled roots	1,866 (81.5%)
Number with healthy root ends	1,227 (65.7%)
Number with diseased root ends	639 (34.3%)

*In this classification, we have arbitrarily called the filling good when the roentgenogram showed the canals completely filled to within 1 mm. of the root end. If the filling material passed the root apex, it was considered overfilled, and if it failed to reach to within 1 mm. of the apex or if the entire diameter of the canal was not filled, the case fell in the underfilled group.

TABLE 3.—DISTRIBUTION OF CASES STUDIED AS TO TYPES OF TEETH TREATED

Total number of molars with root canal fillings	808 (35.2%)
Number with healthy root ends	572 (70.7%)
Number with diseased root ends	236 (29.2%)
Total number of bicuspids with root canal fillings	788 (34.8%)
Number with healthy root ends	530 (67.2%)
Number with diseased root ends	258 (32.7%)
Total number of anteriors with root canal fillings	695 (30.0%)
Number with healthy root ends	467 (67.2%)
Number with diseased root ends	228 (32.7%)

our results, a citation from current literature is in order. In his last publication, Edmund Noyes wrote: "The most obvious and important conclusions from the research work hitherto accomplished is that root canal operations should be done with much more care and thoroughness than has ever been the case with a large majority of practitioners."[8] When we consider the large number of drugs and the various technics offered during his many years of close observation, is this not a significant statement? Two years ago, it was my good fortune and pleasure to be appointed chairman of a group invited by this society to study and discuss the problems presented by the pulpless tooth. It was indeed gratifying to all members of this committee to find that there was no difference of opinion concerning any of the fundamentals governing this branch of dental therapeutics. The data compiled by those whose work has been chiefly in the laboratory agreed with the statistics gathered by those engaged in

8. Noyes, Edmund: The Pulpless Tooth from the Standpoint of the General Practitioner, J.A.D.A., 13: 71 (Jan.) 1926.

the clinical side of the problem. The idea prevalent throughout the profession that the laboratory would not duplicate the clinical findings is not in accord with the foregoing statement.

The laboratory presents much evidence in support of the opinion that many teeth have been treated in a careless and indifferent manner in the past and also that there is frequently complete regeneration of tissue in those cases that we have every reason to believe were carefully managed. The whole situation, as seen from laboratory evidence, may be briefly stated thus: Whenever a pulp is removed and the canal treated and filled in a manner that is compatible with or favorable to a physiologic reaction, we may expect a satisfactory percentage of success. Also, whenever treatment is carried on in such a way as to antagonize biologic processes of repair, we will continue to have many failures. As we see the question, it does not materially matter if an operator uses one style of an instrument, while another prefers a broach of different pattern, provided each will do the task for which it was designed. The crying need is not a new technic, a new drug or the like, but a better and more keen appreciation of the processes by which nature repairs traumatic injury or overcomes an infectious process. Do not misunderstand me: I do not believe that the ideal method for caring for these conditions has been developed, but whatever advance or refinement of technic is made in the future must be along the the lines of adapting the treatment to the natural defensive mechanism of the body.

A recent review of the cases treated by the third and fourth year students of the University of Illinois may be of interest. The findings in a study of those cases in which vital pulps were removed under local anesthetic are given in Table 4.

TABLE 4.—CASES IN WHICH VITAL PULPS WERE REMOVED UNDER LOCAL ANESTHESIA

Number of cases studied....	365
Total number of canals in these cases	697
Number of canals inaccessible	51 (7.4%)
Number of canals with good root fillings	130 (18.6%)
Number of canals with overfilled roots	117 (16.7%)
Number of canals with underfilled roots	445 (63.8%)
Number of cases with normal root ends	274 (75.4%)
Number of cases with involved root ends	73 (20.1%)
Number of cases undetermined	18 (4.9%)

TABLE 5.—DISTRIBUTION OF CASES AS TO TYPES OF TEETH TREATED*

Number of molars treated..	156 (42.7%)
Number with normal root ends	110 (70.5%)
Number with involved root ends	38 (24.3%)
Number undetermined	8 (5.1%)
Number of bicuspids treated.	117 (32.0%)
Number with normal root ends	93 (79.4%)
Number with involved root ends	21 (17.8%)
Number undetermined	3 (2.5%)
Number of anteriors treated	92 (25.1%)
Number with normal root ends	68 (73.9%)
Number with involved root ends	18 (19.5%)
Number undetermined	6 (6.5%)

*The average age for all patients in this group is 24.9 years, the youngest being 9 and the eldest 65.

Findings in a similar study of the cases of chronic root end infection which were treated through the root canal are given in Table 6.

TABLE 6.—CASES OF CHRONIC ROOT END INFECTION TREATED THROUGH THE ROOT CANAL

Total number of cases studied	469
Total number of canals in these cases	737
Number of canals inaccessible	45 (6.1%)
Number of canals with good root fillings	170 (23.0%)
Number of canals with overfilled roots	276 (37.4%)
Number of canals with underfilled roots	291 (39.4%)
Number of cases with apical tissue regenerated or showing marked improvement	343 (73.73%)
Number of cases still showing involvement	86 (18.49%)
Number of cases undetermined	36 (7.74%)

TABLE 7.—DISTRIBUTION OF CASES AS TO TYPES OF TEETH TREATED

Number of molars treated	117 (24.9%)
Number of cases showing marked improvement	88 (75.2%)
Number of cases still showing involvement	20 (17.7%)
Number of cases undetermined	9 (7.6%)
Number of bicuspids treated	127 (27.0%)
Number of cases showing marked improvement	88 (69.2%)
Number of cases still showing involvement	31 (24.4%)
Number of cases undetermined	8 (6.2%)
Number of anteriors treated.	225 (47.9%)
Number of cases showing marked improvement	170 (75.5%)
Number of cases still showing involvement	40 (17.7%)
Number of cases undetermined	15 (6.6%)

The average age of this group is 24.3 years.

In a recent publication, Edgar D. Coolidge,[9] in summarizing the cases that he has treated in office practice asks: "If this report indicated the possibility of saving all but three out of 100 pulpless teeth, is it not proper that we should continue root canal treatment?" While the review of our cases does not give as high a percentage of success as that of Dr. Coolidge, I ask: if it is possible to have a 73 per cent success in cases of chronic root end infection and 75 per cent success in removal of vital pulps with third and fourth year students as operators, should we not expect a much higher percentage of success from every man in general practice?

CONCLUSION

1. Both laboratory and clinical evidence is at hand to demand the placing of root canal therapy upon a basis that is not antagonistic to body reactions.

2. The sciences of histopathology and bacteriology, as well as clinical evidence, support the statement that many teeth have remained in a satisfactory condition for years after pulp removal.

3. With student operators, we have been able to attain a reasonable percentage of success, which indicates that the technic is not so difficult as to demand the creation of a separate phase of practice for the specialist.

4. As far as I have been able to observe, the fact that a tooth has lost its pulp, or even, in some instances, that a degenerative change is in progress surrounding the root end, is not sufficient reason for tooth extraction.

9. Coolidge, E. D.: Dent. Cosmos, 69: 1280 (Dec.) 1927.

WHAT TEETH SHOULD BE EXTRACTED: FROM THE VIEWPOINT OF A RESEARCH PATHOLOGIST*

By EDWARD H. HATTON, B. L., M. A., Chicago, Ill.

APPROACH to the answer to the question "What teeth should be extracted?" is difficult no matter from what angle that approach is made. The actual solution of the general problem of the individual case can be made only by careful examination of the tooth by various pathologic methods. It is quite as clear that such a solution is of no particular benefit, either to the operator or to his patient, and that an effort must be made to anticipate the findings of the pathologist in the clinical study of the situation before extraction.

In the effort to simplify this situation and to formulate a rule of procedure for the practitioner, various compromises have been arrived at. The most common method is to depend on the roentgen-ray film, using this device to group teeth into two classes: (1) those that are negative and (2) those that are positive on roentgen-ray examination. The tendency is to extract the teeth in the latter group and to retain them in the former. Even such a method has its uncertainties, as there is a great deal of doubt as to what constitutes a roentgenographically positive tooth. In addition, there is a group of bacteriologists who are quite willing to challenge the findings of the roentgen-ray film, especially the film diagnosis in the case which is negative roentgenographically. This challenge is quite serious because of the great dependence that has been placed on this form of diagnosis. No thoughtful person will dispute the statement that the roentgen-ray film is merely a record of relative penetration of the various tissues by the radiations from the roentgen-ray tube, and that it largely portrays only changes that have taken place in the hard tissues. It may show the results of the reactions produced by pressure or inflammation, but it can supply no direct information as to the presence or absence of infection. On the other hand, it does supply strong circumstantial evidence concerning such matters. After a careful examination of anatomic material by gross and microscopic methods after roentgen-ray films had been made and interpreted, it seems reasonably clear that if its limitations are fairly well understood, the roentgen-ray is a most dependable source of information. Usually, conditions in the specimen are no better than they seem to be in the roentgen-ray film, and often they are worse. This possibility should always be considered.

The second approximated rule has to do with the pulpless tooth. It is usually stated that, while perhaps not all pulpless teeth should be extracted, if there is any doubt at all in the mind of the diagnostician, such teeth should be condemned. A great deal of confusion has arisen in the minds of physicians, dentists and laymen because of the fre-

*Read at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

quency of belief that pulpless teeth are dead teeth. Without going into a discussion of this statement, the opinion may be offered that such a contention is far from being proved. It is unfortunate that such discussions have arisen because they distract our attention from the important matter of infection. After all, it is this item that should concern us; for it is just as possible that teeth with living pulps may harbor localized abscesses and low grade infection. As a rule, such changes cannot be seen in the roentgen-ray film, and may be overlooked. It is true that such infections are not so common as apical infections, and that, presumably, they are not confined to the pulp for long periods of time.

The whole plea may be summed up in the suggestion that we look for dental infection, and that we be governed by the information gathered, not only from the roentgen-ray film, but also from all other available sources, without any particular bias toward the pulpless tooth.

In addition, the operator and diagnostician must be governed by the amount and kind of destruction that has taken place in the investing tissues of the tooth, particularly the pericemental membrane and its relationship to the cementum. In spite of the claims of many clinicians, one cannot believe in the wisdom of trying to salvage many teeth the apices of which have been infected for some time. The extent to which the pericemental membrane has been detached is clearly outlined in histologic specimens by a zone in which new cementum is being produced, a zone which is presumably as clearly marked in the roentgen-ray film, though on a more minute scale, and is, therefore, worth looking for. Unless one can demonstrate that the amount of detached pericemental membrane is relatively small by some such method as the one suggested, isn't it better, not only from the standpoint of focal infection, but also because there is but a slight chance of a satisfactory restoration of the periapical cementum, either to extract such teeth or, in favorable cases, to perform a root resection?

There seems to be current a notion that if it is proper to extract all suspected teeth from a person who is suffering from a chronic condition which is supposedly due to a focus of infection, it is even more essential that this be done early enough in all cases to prevent the occurrence of all such conditions: a notion, for example, that assumes that, in many people who have a high resistance to infection, pulpless teeth are safe only as long as that high resistance persists. It would appear, furthermore, according to this type of reasoning, that this resistance to infection is a very unstable property of the human body and liable to sudden and uncertain changes, and during such periods of lowered resistance to infection, the menace of pulpless teeth is greatly enhanced. Is this a reasonable hypothesis? Apparently, there is no body of experimental evidence concerning such a supposition.

If such a discussion were limited to the diseases about which we have considerable knowledge as to the fluctuations and variations of immunity, for example, typhoid fever, smallpox and diphtheria, any belief in a considerable variation in the degree immunity or susceptibility is absolutely untenable. To accept such a possibility would strike at the very foundation of practices of immunization by vaccination. Since such practices of immunization are becoming more extensive and are including even the streptococcus group of infections, it seems much more plausible to assume

that there must be some such immunity to focal infection and that this type of immunity must be relatively stable and not subject to any great amount of variation.

Since there is no evidence that such statements are not true and no evidence that the presence of pulpless teeth actually lessens the immunity to chronic infections elsewhere in the body, it may be concluded that, in this very considerable group, extraction is to be resorted to only when tooth infection cannot be controlled in any other way.

On the other hand, in a second group of individuals who either already are suffering from the effects of chronic infections or are susceptible to chronic infections, or who come from families in which chronic infections are common, a different method of procedure is advisable. The reasons for adopting such a program are based not so much on the probable efficacy of the method as on the desperateness of the situation, and just as tradition has the drowning man grasping at straws, so here extreme measures are used to combat a situation about which we know too little. It is well known that, in fighting acute contagious diseases about which we know little, measures are used which, in the light of subsequent knowledge, may appear ridiculous and, at the same time, no effort exists to do things absolutely essential to control the situation. Such an instance may be cited in the handling of the yellow fever situation before and after the discoveries of Reid and his associates.

Without a doubt, in the handling of this group of individuals who are so susceptible to the ravâges of the low grade infections that are associated with what we know as focal infection, we are acting in a way that, in the light of more information and to a later generation, will seem quite as ridiculous, but, in the present stage of knowledge, it is the best that we can do. And since it is the best we can do, we must do it, not because we can promise ourselves or our patients that it is going to cure, or that it is going to enhance their immunity to chronic infection, but because, in a certain fraction of such cases, the application of such a method of treatment has resulted either in improvement or cure.

This subject cannot be closed without some reference to the possible menace either of unnecessary extraction or of necessary extraction in individuals already suffering from degenerative diseases. This has been discussed recently[1] on the basis of a small series of necropsies that have been made on the bodies of individuals dying a short time after the extraction of a number of teeth. In all of these instances, there were degenerative conditions in important organs of the body that were connected with this comparatively insignificant surgical procedure. Two statements from this discussion are selected for quotation.

Too many instances are now on record (and probably the reported cases represent only a small minority of serious conditions following extraction of teeth) of dental and medical thoughtlessness in the extraction of teeth in more or less serious conditions.[2] Too many teeth are extracted without clinical or pathologic justification. Two opposing conditions are constantly present: first, all infection in the mouth must be eradicated; second, teeth should not be

1. J.A.M.A., Editorial, 90: 121 (Jan. 14) 1928. Buckley, R. C.: Necropsy Reports on Persons Dying Shortly After Extraction of Teeth, J.A.M.A., 89: 1776 (Nov. 19) 1927.

2. Footnote 1, first reference.

extracted if the infection can be otherwise eliminated.[3]

One cannot quarrel with such a statement of a reasonable program for the dentist with respect to extraction. The actual application of such a program to the exigencies of practice is, of course, beset with difficulties, but it would seem that most of these difficulties are far from being insurmountable.

3. Footnote 1, second reference.

PHOTOGRAPHY AND ITS USES IN PROSTHESIS*

By E. H. BRUENING, D.D.S., F.A.C.D., Omaha, Nebr.

WHEN the physiologic and mechanical factors in a full denture case are all favorable, the individual must still undergo much discomfort in trying to learn to wear his artificial appliances; but when there is added to this the disappointing change in appearance that we sometimes see, we must admit that the patient has cause to feel discouraged. The comments of his friends and members of his family do not help him or us. If he can say that his dentist has photographs and measurements taken before he lost his teeth and will attempt to reproduce his former expression, it will help him past this unpleasant period.

The most valuable of these records are the photographs which we can so easily make in our own offices, and it is the purpose of this paper to show how this can be done. It is easy to make a motion picture film to show any dental operation or technical procedure for clinical or teaching purposes. These small, inexpensive machines are fitted with high speed attachments that take sixty-four pictures a second and produce the slow motion film; also with a crank that individualizes each exposure, with which, for instance, they can illustrate the opening of a flower. With the present-day efficient lenses and high powered lamps, the amateur is producing very satisfactory results at nominal cost.

Many kinds of cameras can be satisfactorily used to make photographs of faces. I have found the equipment made by the Eastman Kodak Company ideal for our purposes. It is a 5 x 7 view type machine with a bed graduated to produce an image ¼ x ½, or full, natural size. The one-half natural size is best for our uses. To facilitate the camera adjustment for an image of this size, we have had made a focusing guide of correct length for our machine and combining with it a spirit level and an upright with which to parallel the face. By placing this guide against the upper lip and the other end against the lens housing, our subject is brought into sharp focus. With a little care and practice with this instrument, you will find the focusing cloth unnecessary.

The unfortunate person who must sacrifice his dental organs is entitled to the best service as far as esthetics is concerned. We are now able to produce excellent mechanical results in full denture construction, thanks to the wonderful work done in, or stimulated by, the

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 27, 1927.

National Society of Denture Prosthetists; but one need only look into the faces he meets on the street, in a store or in any gathering of people to see the many unpleasant expressions on misshapen faces due to loss of teeth followed by improper or neglected denture service.

If one of these is our patient, how can we best convince him that the dentures made a year or two ago have served their purposes? They no longer fit, owing to the changes that have taken place so slowly that he has been unaware of them; yet he says that they function satisfactorily.

Let him compare, with his image in the mirror, the photographs that were made just before the extraction of his teeth. He will remember the comparisons he made two or three weeks after he began wearing his new dentures. At that time, he was well pleased with the results as there had been practically no difference in his expression. Today, he finds a most remarkable change. He looks older, his mouth droops, his chin is too prominent, his upper lip is much flattened, even the expression in his eyes is different. The tissues have lost tone and the lower half of the face appears to sag. The muscles of the throat have also suffered impaired function. He is very much encouraged when he learns that a rebuilding process is possible and will go a long way toward improving his expression by reproducing his normal facial dimensions as they had been previously recorded photographically and with such other records as the operator may have taken.

In a case of this kind, it is good practice to make additional photographs as soon as he has become accustomed to his new or corrected dentures. These are compared with set No. 1 and filed away for future reference. Comparisons and checkups should be made once each year.

Building a face from disharmony to harmony is a most satisfying accomplishment; but without the aid of photographs of our case, we cannot demonstrate this change either to ourselves or to the patient, as in those cases that have protruding, elongated, overlapping upper incisors, in which the removal of a small amount of alveolar process allows us to make a correction with most interesting results.

When we show the patient the pictures made before operating and let him compare them with the results obtained in his case after he has worn his new dentures about three weeks (it requires about this length of time for the tissues to sufficiently adapt themselves to the dentures to overcome the strained or taut appearance of the lips), he will be better satisfied, and it will help him forget some of the discomforts that he must undergo in trying to learn to masticate food.

We have a better opportunity to study facial form and expression of a patient when we have a picture with which to make comparisons with photographs made some years before. The comparative dimensions of the face, length of upper lip, depth of the nasolabial fold and relative position of the chin are a few of the important lines that can be better established by comparing photographs. Our picture can sometimes be made the same size and from the same angle as the old one by measuring the object on the photograph, marking the same size on the ground glass and adjusting the camera so that the image appears in focus within our markings.

Occasionally, a patient requests that records be made of his face and teeth

to be filed away for use in case he should some day lose his teeth. Four photographs are made, with accurate casts of the teeth, and such other measurements as the operator may find useful.

Beginning with a much foreshortened case, it is good practice to keep a photographic record of the condition as it came to you and be able to check results later with the photograph of the corrected case.

We have had many examples of cases in which the individual objected to the discomfort incident to "opening the bite" until he saw in the photographs the indisputable improvement in his appearance.

Many patients are interested to know just how much change has taken place since the last dentures were made and are glad to have the opportunity to again see their photographs and have the profile guide adjusted. If there is a noticeable difference, they will want a correction made at once; which of course should be done.

TECHNIC OF MAKING PHOTOGRAPHS

Our offices are usually ideal for making photographs of faces on account of the large window in front of our operating chairs. (Artificial light can be used with excellent results if one prefers this method.) To prepare the room, raise the shade and place the camera, plate holders and focusing guide in convenient position, dropping the head rest to keep it out of the picture and straightening the chair back. Instruct the patient to sit upright and hold the head in a fixed position and the teeth in gentle occlusion. Adjust the focusing guide and camera and have the assistant keep a neutral colored or black cloth in motion back of the patient's head to eliminate all undesirable background. Adjust the shutter for bulb exposure and set the stop at perhaps F. 11. Put in a plate holder, and we are ready for the exposure, which requires about one second. Quickly reverse the holder and expose the other plate with the lips and teeth separated as they would be when smiling. A third will show the extreme exposure of teeth and gum tissue (our patients often forget how much of their natural teeth was exposed when they laughed).

There can be no error in this record. The next exposure is for the profile. Rotate the chair and adjust the camera to obtain a full profile view, have teeth again in gentle occlusion, adjust the focusing guide and expose the plate.

The teeth in occlusion may be in a foreshortened position, but when corrections are made we use this as the starting point from which to measure the difference between this position and a rest position. The difference can be added to the profile picture, by sketching it on. There are many more ways in which these records can be used that will suggest themselves to the operator as he becomes more appreciative of their value.

We agree with B. E. Lischer, of St. Louis, who recently published an article in which he says, "Office portraiture and stereoscopic photography constitute the next step in our utilization of photography." It is certainly more convenient if the practitioner is equipped to execute the necessary photographic work. It becomes an agreeable diversion to him who, in the love of his vocation, practices his art in accordance with its highest principles. It leads to a routine which seizes the unlimited opportunities for improving his services; it acquaints him with a wealth of material which heretofore passed through his hands unnoticed; nor does it fail to sharpen his

critical judgment of the many malformations entrusted to his care.

DISCUSSION

J. B. La Due, Chicago, Ill.: There is no phase of denture construction that is more important than the esthetic. Facial proportion is one of the most essential component parts. A casual observing of denture wearers will lead you to conclude that little or no consideration has been given this part. An edentulous patient has had enough misfortune in losing the masticatory organs. It is unfair to restore these organs in such a manner that a mere glance discloses the fact that one is a cripple; and indeed crippled is the correct classification. Positional photographs are a great aid in restoring facial proportions. When the physiologic factors are normal, restorations may be made to actual photographic measurement. When this is not possible, photographs made when abnormal conditions are present are of great value for comparison with the finished result. We are then able to prove the points in which we have made improvement. Photographs taken years ago are of little value, except they be a profile view. Accurate measurements made of curved surfaces reproduced on the flat are not possible. Retouched photographs usually have most of the character lines erased. This, of course, is prompted by the commercial point of view of the photographer in appealing to the vanity of the subject by producing all the beauty possible. These are worse than useless, and much confusion will be produced if we associate an ideal that never was with what we will eventually arrive at. There is no step in the technic on which I can take issue. I want to stress as forcibly as possible practically all of them. Personal equation is our only difference. I have been using actual sized photographs and a cut-out silhouette instead of the wire profile measurement. I have employed a commercial photographer to do this work for me, but I am always present when the photographs are taken. Since coming in contact with today's presentation, I am convinced that doing our own work is better, both from result and economic standpoint. It is hardly to be expected that all will follow this procedure, but if any advance is to be made, a standard must be set that is much higher than the average demand.

NEW METHOD IN REDUCING FRACTURE OF THE ZYGOMATIC ARCH

By M. F. WIELAGE, D.D.S., Miami, Florida

THOUGH many will contest the idea that a fracture of the zygomatic arch belongs to dental and oral surgery, I believe that it has its place in this profession, if malocclusion accompanies the fracture. If the blow was directed toward the malar bone, this will often be the case. If a successful reduction can be obtained by the intraoral route, which will simplify the procedure, there should be no objection to our action.

The patient under consideration presented a fracture of the zygomatic arch, with the malar bone caved in, malocclusion resulting in the region of the left maxillary molars. The impact of the blow on the malar bone produced a clean fracture of the zygoma. There was slight pain in the region of the nose, but radiograms did not reveal a fracture in that area. Medical books did not give any method of reduction. One book on oral surgery advised the

use of tenaculum forceps applied from the outside. Not being satisfied, I devised the following method, which is clearly illustrated in the accompanying sketches.

In injecting the local anesthetic, the needle was carried upward, behind the malar bone, discharging the solution while proceeding. A tiny incision was made in the mucous fold opposite the third maxillary molar. A slightly curved periosteal elevator was advanced, bluntly dissecting upward until it rested on the distal part of the malar bone. Grasping the elevator firmly and bringing the thumb slightly upward, until it rested on the outer part, I proceeded by diligently pulling the malar bone outward. The left arm was placed around the patient's head, the left index finger along the zygomatic arch. When the malar bone was brought out far enough, so that broken parts of the arch were in

Fig. 1.—Periosteal elevator in position to reduce fracture.

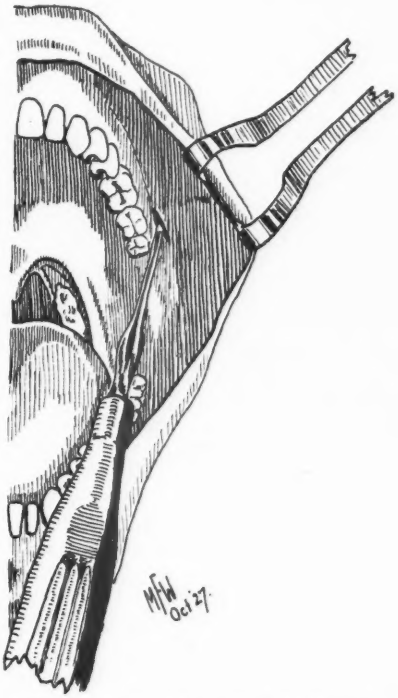

Fig. 2.—Incision for periosteal elevator.

apposition, the pulling motion was stopped. Normal occlusion was reestablished, and the patient was put on a liquid diet for two weeks. Sodium hypochlorite solution was prescribed as a mouth wash. The incision healed in four days. Recovery was uneventful.

If we have this condition to treat in the less intelligent class, I would advise wiring the mandible to the maxilla or using a Barton bandage.

The contour of the face was made normal and occlusion was reestablished. The operation was simple and was not noticeable from the outside.

The objection to following the oral route on account of possible infection is carried too far. In the hands of a

conscientious operator, there is no danger. This is proved every day in the dental office. Leaving the fracture to heal without reduction has no place in surgery.

504 Huntington Building.

THE RELATION OF BACILLUS ACIDOPHILUS TO DENTAL CARIES*

By RUSSELL W. BUNTING, D. D. Sc., GAIL NICKERSON, M. S., DOROTHY G. HARD, D. D. S. and MARY CROWLEY, A. B., Ann Arbor, Mich.

WE have previously reported that, in a survey of more than 400 individuals, children and adults, *Bacillus acidophilus* bears a definite relationship to the inception of dental caries and that the correlation in the cases which we studied was over 98 per cent; that is, *Bacillus acidophilus* was practically always present in cases of beginning or active caries, and it was almost invariably absent from mouths which were free from that disease.

In order that we might obtain further evidence in this direction, we have this year studied clinically and bacteriologically more than 1,300 children, many of whom were examined two or three times during the year. These children were all in special groups, in public schools and in children's homes or orphanages. Here, we had the opportunity to compare the differences between public school children who live under the varying conditions of private homes and children living under the more uniform conditions of children's homes or orphanages. In this comparison, certain general characteristics were apparent. Among the public school children who had not had any unusual dental supervision, dental caries was very common, and *B. acidophilus* was very closely correlated with the presence or absence of that disease, the data being quite similar to that which we had previously obtained. We found, however, that in certain orphanages and in other groups of children who had received especially good dental care, there was a varying percentage who, at one time, had had dental caries but in whom we were unable to detect *B. acidophilus*. In practically all such cases, however, we found that either the cavities had all been filled or the diseased teeth extracted, and that no new caries was evident; or, if open cavities were present, they were dark and showed no evidences of activity. From the observations which we have made this year, then, we have come to recognize that there is a difference between the bacterial flora of active caries and that of caries which for any reason has become inactive.

It is a most significant observation that those children in the public schools who come from private homes have so large a percentage of caries, while the children in many orphanages have a much lower degree of caries, a considerable percentage of which is inactive

*From the Laboratories of the School of Dentistry, University of Michigan, Ann Arbor, Mich.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

The question immediately arises: What is the cause for this difference in the dental health of these two groups of children?

In a search for the controlling factors which might be involved, we found that, in three children's homes where the best dental conditions existed and where the dental caries was most inactive, two general factors prevailed: first, that these children had been provided an unusually good diet and, secondly, that they had received careful dental supervision. In each of these institutions, a competent dietitian was giving special attention to the feeding of the children according to the present known methods of diet and nutrition. The diet was plain, well-fortified, and, as a rule, more nearly adequate from a nutritional standpoint than that which prevails in the average private home. Each of these groups of children was also receiving regular dental attention, in which all open cavities were filled and seriously decayed deciduous teeth were removed. In these children, oral infections were extremely rare, and, interesting to note, respiratory infections and children's diseases were much less prevalent among these children than in other groups.

Which of these factors, diet or dental care, is most important is not apparent at the present time. In a study of this question, we surveyed three schools in Pontiac, Mich., where it is said that the children receive the best dental care that is given in any school community in the state. The first school had received 100 per cent dental care, the second had had less careful supervision, and the third, a parochial school, had had almost none. In these three schools, respectively, the following percentages of caries were found: 82, 88 and 98 per cent. The differences in the oral conditions which prevailed in these groups could be attributed only to the degree of dental care that the children had received.

In another study, in which we surveyed a smaller group of children in an orphanage where the diet had been less favorable than in some other institutions and where but spasmodic and inadequate dental attention had been afforded, we made the experiment of putting these mouths in as nearly perfect condition as possible without changing the diet. This work has only recently been undertaken. At the beginning of the experiment, 92 per cent of the children had caries, and one week after all cavities had been filled or the diseased teeth had been extracted, 23 per cent of the children who previously gave positive reactions to *B. acidophilus* were found to give negative reactions. Just how nearly permanent this change will be or its effect on the future program of dental caries cannot be answered at this time, but these children will be followed over a period of from one to two years to determine by clinical and bacteriologic surveys just what their life history will be.

At the present time, we are planning to study 500 children in two institutions on a prescribed diet consisting of a highly fortified ration in which sugar has been reduced to the minimum. These children will be surveyed clinically and bacteriologically over a period of from two to three years. In this manner, we hope to obtain some definite information in regard to the relative effectiveness of diet and dental care in the control of *B. acidophilus* infections in the mouth and their influence on dental caries. In this survey, we found twenty-two children who had never had dental caries but from whom positive cultures of *B. acidophilus* were obtained. In several of

these children, six to be exact, it was found subsequently that cavities were beginning to appear and that there was every evidence of active decalcification being present.

It is not to be wondered that in so large a group as we surveyed, some would be found in which the organism would be present in a transitory form under conditions in which it was unable to produce its characteristic action on the teeth, or that we would find some cases in which the organism had lately become implanted in the mouth and sufficient time had not yet elapsed for the production of a definite lesion. In this connection, we might say that in the thousands of cases which we have examined and have followed over a considerable period of time, there have been only a very few individuals found who were wholly free from dental caries in whom we could find any trace of *B. acidophilus;* and, on the other hand, we have recorded but *one* case in which caries was evidently active in the mouth and *B. acidophilus* could not be found. The surveys which we have made show a direct correlation between *B. acidophilus* and the disease of the teeth known as dental caries which is just as definite and uniform as that which exists between the tubercle bacillus and phthisis, the Loeffler bacillus for diphtheria, or *Spirochaeta pallida* for syphilis.

In our former communications, we have called attention to the beneficial effects that we have observed in the control of dental caries through the limitation of *B. acidophilus* by the use of metaphen. As we have formerly stated, this preparation is highly antagonistic to *B. acidophilus* overgrowths, and in every instance in which it is used in the manner which we have suggested, the overgrowths are greatly reduced and, in many instances, the mouth is entirely rid of all traces of the organism. Its action is not uniform in that it seems to be much more effective in some mouths than in some others. To determine the degree of its effectiveness, we instituted treatment of a group of patients in the dental school clinic by dental students and hygienists, and checked the cases bacteriologically to determine the results obtained. One hundred and six cases were treated by dental students, of which 52 per cent became negative at the end of three treatments. Those that were still positive were given three additional treatments, and 50 per cent of them became negative. The hygienists treated seventy-two cases, of which 40 per cent became negative at the end of three treatments, and 50 per cent of the remainder at the end of six. These data include only those cases in which there was total elimination of the organism from the mouth as far as we could detect from bacteriologic cultures. In all cases so treated, there was a marked reduction of bacterial activity even though in many there was not a complete elimination of *B. acidophilus.*

During this study, we have noted a marked inhibitory effect of metaphen on the activity of dental caries. Very extreme cases have now been under observation for more than two years, during which time there has been either no appearance of new caries or, if caries has occurred, it has been as small obscure lesions which were located in accessible places.

CONCLUSIONS

1. In a survey of 1,335 children, it was found that the presence or absence of *B. acidophilus* in the mouth is directly and definitely related to the activity of dental caries.

2. In repeated examinations, a spontaneous cessation of caries was noted coincident with the disappearance of *B. acidophilus* from the mouth.

3. Certain cases in which *B. acidophilus* was found to be present in mouths apparently free from dental caries, at a later examination had developed new lesions of active caries.

4. The presence or absence of *B. acidophilus* in the mouth constitutes a more accurate means of diagnosing the activity of dental caries than any clinical estimation can afford.

5. It was noted that the degree of activity of *B. acidophilus* and dental caries in the mouth was distinctly related to the type of diet and the form of dental attention which was afforded.

6. Metaphen has been found to be distinctly inhibitive to *B. acidophilus,* and, in those cases in which it has been regularly applied, it has been found to exert a marked restraining effect on the activity of dental caries.

DISCUSSION

F. W. Holt, Detroit: Is there some means whereby the general practitioner, in ordinary practice, like myself, can discover *Bacillus acidophilus?*

Dr. Bunting: Unfortunately, it is not feasible for the general practitioner to determine the acidophilus content of the mouth. It requires a bacteriologic technic that is not easily carried out by a dentist. And I am hoping that if this shall prove, in the future, to be worth while, we shall have bacteriologic laboratories in the United States to which cultures can be taken and a verdict be given as to the acidophilus content. At the present time, it is not an easy matter, as it requires a laboratory and trained laboratory workers to do this.

A. K. Steen, Fond du Lac, Wis.: What are your findings as regards the action of milk of magnesia on *Bacillus acidophilus?*

Dr. Bunting: I have no information on that. There are many methods that we might employ. We are hoping to try many things. At the present time, we are doing just what we can do, with our limited facilities. There are any number of ways in which we can control *B. acidophilus.* We hope some simple way may be found.

George Evans, New York City: In the many years of my practice, I have endeavored to abolish among children the use of cane sugar, substituting bananas, raisins, dates and prunes. I have done that with my two grandchildren, endeavoring to control the caries in their teeth. I should like to ask Dr. Bunting whether he has considered substituting for sugar saccharine matter which is necessary in the system, furnishing it by some other agency than cane sugar.

Dr. Bunting (closing): In answer to the question as to what sorts of sugar could be allowed, I have asked physicians and dietitians and those qualified to give an opinion, one of them being Dr. McCollum. I said, "How far can I cut cane sugar out of children's diet, without harm to the children?" He said, "Cut it all out." That is about what we are doing, if it is at all possible.

A PLEA FOR CONSERVATISM IN OPERATIVE PROCEDURES*

By JAMES MARK PRIME, D. D. Sc., F. A. C. D., Omaha, Nebr.

DEMOCRACY in thinking means liberality of thought. In religion, progressive minds are bound by creeds and dogmas. The great political parties are bound by platforms framed by politicians. The student mind is too often stifled by rules of the institution or by hobbies and pet theories of professors.

Would we have had a Copernicus, a Galileo, a Newton, a Faraday, a Pasteur, a Lister or a Black had these men been compelled to labor in the shadow of superstition or had they been shackled by rules of learning in some institution?

A nation's greatness is measured not by the size of its navy or by its wealth, but by the men it produces.

The business of a college is not limited to making men: its bigger duty is to discover men. Great minds cannot develop as long as they are held within the limits of a textbook.

The scientific mind is ever hungry, and it finds food on every hand. To it, the spider in the corner of the attic and the fresh blade of grass pushing its way through the soil at the back doorstep hold absorbing lessons. It never overlooks the smallest detail. There is nothing too little to stir its imagination or excite its enthusiasm. It does not anger at criticism. A challenge to it is an act of friendship. It turns a challenge into an opportunity—an opportunity to learn. It has learned how easy it is to be wrong, and seeing wherein it is wrong, with an open mind it accepts. It puts evidence above fiction, fact above victory, and truth above self. He who "wrestles with him is his friend." "Acts may speak louder than words" to some, but to him, facts speak louder than either acts or words. He would "rather be right than be president." He would rather be able to think straight than to possess great riches. If he belonged to the dental profession, he would believe in and practice conservatism. He would put the well-being of his patient above the fee. He would be slow to try out unproven methods at the expense of his patient. He would keep uppermost in mind at all times the value of the dental pulp and would not unnecessarily endanger it by ruthless cutting. He would always welcome, from whatever source, a method with which he might get his results with the least destruction of tooth tissues.

The dentist who operates on teeth and through his excessive cutting causes them to fracture, or causes the pulp to die, or permanently injures the gingival tissues, in any event bringing about the ultimate loss of the teeth, is comparable to a lifeguard who brings in the drowning person, but, by reason of his severe

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

methods, so injures him that he later dies.

My observation leads me to believe that we have been and still are cutting teeth unnecessarily. The use of procain has aided and abetted the crime. After cutting through the hard enamel, how smoothly and rapidly the bur buries itself in the soft dentin. Is that it, or is it because we can adapt a larger piece of wax better in a deep, wide cavity? Is it because we can anchor our amalgam or cord our gold cylinders more easily in a deep box cavity? Or is it just plain indifference and carelessness? Whatever the cause, we must avoid it, or we will reap a harvest of indignation from patients made to wear glaring gold and discolored teeth with dead and dying pulps.

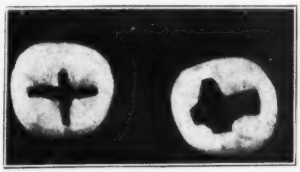

Fig. 1.—Molar cavities filled with black compound.

With the conviction that something should be done to check this excessive and unnecessary cutting, this essay is offered.

Class one, or pit and fissure, cavities are the most abundant. It is now being claimed by those who have made exhaustive tabulations that there are more pit and fissure cavities than all others combined. They should be filled early, many times soon after the teeth are erupted, and should be cut only enough to follow out the fissures, and only deep

Fig. 2.—Cross-section of molars with compound fillings.

Fig 3.—Bicuspids and molars with pit and fissure cavities filled with cohesive gold foil.

enough to remove all the carious dentin and no more. Extension for prevention does not apply to these cavities.

I sent an extracted molar to a friend and asked him to prepare a class one cavity as he was taught to do in college and as he does in practice. I prepared one according to what I consider a more conservative method.

Figure 1 shows the two molars with the cavities filled with black compound. The compound was used because it shows the cavity outline better than gold or amalgam. Figure 2 shows a cross-section of the two molars with their compound fillings. Observe the hazard to the dental pulp in the wide, deep cavity as compared to that involved in the shallow, small cavity. The molars, which, with their cavities were as nearly alike as possible, were selected before the cavities were prepared. Let us take into account the unnecessary pain to the patient and labor to the operator, in cavity preparation, filling and finishing in the one with the deep cavity, as compared with the pain to the patient, the time and labor involved both in filling and in finishing the small cavity, all of which were reduced to the minimum.

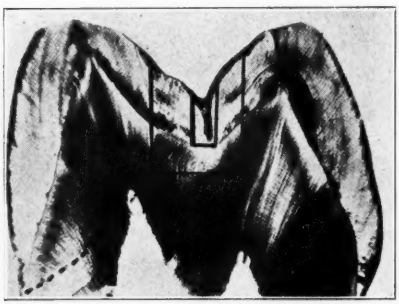

Fig. 4.—Cross-section of a bicuspid.

Figure 3 shows bicuspids and molars with pit and fissure cavities filled with cohesive gold foil.

Figure 4 is a photomicrograph of a cross-section of a bicuspid. The lines outlining the deep box-form cavity show how nearly it would approach the horn of the pulp. The dotted line indicates the probable line of fracture under great stress. Should this occur, it would expose the horn of the pulp.

Figure 5 is a more highly magnified cross-section of the same tooth. Observe that, aside from those points mentioned above, the margins are extended up the occlusal inclination, where they will receive the force of occlusal contact from the antagonizing tooth or teeth. Should a failure begin at *A*, it is apparent how it might follow the wall, until it would be near the horn of the pulp. Consider also the added difficulty of restoring the tooth form when such radical cutting is resorted to.

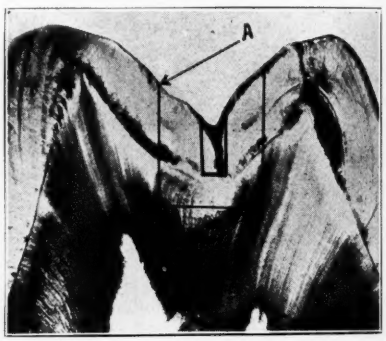

Fig. 5.—Cross-section shown in Figure 4, highly magnified.

The small box, including but little more than the fissure, as indicated in Figures 4 and 5, appears to be the safe, sane and sensible cavity form. After the fault or caries is removed, I enlarge

them only sufficiently to admit very small gold or amalgam pluggers.

The final result is the all important thing. On this point, I ask the hearer to pass judgment.

Figures 6, 7 and 8 show an upper first bicuspid with a mesial Class 2 cavity. Note the narrow, shallow occlusal step. Note also the narrow gingival wall. This cavity could not, of course, be filled with an inlay. It is planned for gold foil. Observe the acute angles cut in the buccal and lingual walls. These are cut with gingival marginal trimmers or Woodbury's angle formers.

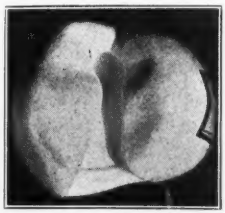

Fig. 6.—Upper first bicuspid with mesial Class 2 cavity.

Fig. 7.—Upper first bicuspid with a mesial Class 2 cavity.

Fig. 8.—Upper first bicuspid with a mesial Class 2 cavity.

Figure 9 shows the instrument in position for cutting the triangular form. Also observe the buccogingival and lingogingival extensions at *A* and *B*. It is a well recognized fact that these are the most vulnerable points. Note also the conservation of the tooth structure at *C* and *D*. Note that the gingival wall is inclined to the axial. This is accomplished with the same two gingival marginal trimmers as are used in cutting the buccal and lingual triangular forms. The advantage is obvious for treating the wall in this manner, because the gold is prevented from sliding out of the cavity as the gingival wall is being covered.

Fig. 9.—Instrument in position for cutting the triangular form.

The proximal portion of the filling is secured and held by the cavity form independently of the step extension. This permits the occlusal step to be made narrow and shallow. Immunization of the central fissure is the principal object of the occlusal extension. Furthermore, should decay begin on the distal surface, there is no danger of dislodging the mesial filling when force is brought against the occlusal extension portion in connecting the fillings. It is apparent that this cavity must be filled entirely with cohesive gold foil. The objection is at once raised that, by this cavity preparation, we lose the advantage of the noncohesive cylinders. Cavities should be no longer cut in vital teeth

deep and wide enough that gold cylinders may be corded in them. When decay has widened and deepened them and the operator chooses to use gold foil, the noncohesive cylinders greatly facilitate the operation, shortening the time and producing excellent results; but if decay has made them deep and wide, the profession is going to make inlays in them. The time has come to adapt the filling materials to the requirements of the tooth rather than to force the tooth to meet the requirements of the filling materials.

Fig. 10.—Upper cuspid with a cavity preserving most of the disto-incisal angle.

A difficult cavity to manage, and one in which excessive cutting is frequently done, lies in the distal surface of the upper cuspid. If there exists a cavity in the mesial surface of the first bicuspid, direct access to the distal surface of the cuspid is made easy; but this is not the rule, and as a result, an unsightly gold restoration is frequently made, involving the disto-incisal angle.

Figures 10 and 11 show an upper cuspid with a cavity preserving most of the disto-incisal angle. Note in this cavity that the gingival wall slopes slightly, forming an acute angle with the axial wall. This cavity is made possible by the peculiar form of the upper cuspid tooth. Because it widens rapidly toward the gingival aspect, it is not necessary to cut excessively to provide a sufficient floor for the lingual extension for retention at *A*. As will be noticed, this is made just lingually to the disto-incisal angle, and in no case should the dentin underlying this angle be removed to the point of undermining the enamel. If caries has undermined the angle, the dentin must, of course, be removed, and the regular incisal step or Class 4 cavity must be made. This cavity does not apply in the mesial surface of the cuspid nor in any of the incisor teeth. It is planned for cohesive gold foil, and any

Fig. 11.—Upper cuspid with a cavity preserving most of the disto-incisal angle.

operator familiar with gold foil technic will, at once, we believe, observe its advantages. The conservation of the tooth structures, the attainment of complete access to all parts of the cavity, the strength of the foil and the esthetic results in comparison to the usual step form are worthy of our consideration. Figure 23 shows the labial view of the cavity filled with black compound.

There is, as a rule, too much cutting of tooth structure in the application of the three-quarter crown on incisors and cuspids. Little mutilation will be caused to these teeth if the technic is consistent with well known mechanical principles. Too often, the labial enamel plate is so undermined that a shadow is developed from the cement, giving to the tooth a bluish-black appearance. There is change

enough in the translucency of a tooth when it is "backed" with a gold casting even though the tooth is cut very little; but when to this are added the results of undermining the enamel and exposing large quantities of gold on the mesial and distal surfaces and the further "insult to injury" of putting gold over the incisal edge, our results are little better, if any, than with an open-face crown or, I could almost say, a full shell crown.

We must cut teeth sufficiently to get a firm grip on them and to give to gold sufficient bulk at strategic points to have the required strength; but cutting beyond a certain point tends to weaken our attachments. It is true also that our cutting may be varied somewhat according to stress requirements, the size of the teeth, their inclinations, the length of the span, etc.; but we should not go to the extreme of disregarding the dental pulp or the esthetics of the case.

We should not court failure. Sometimes, there is a degree of success in failure. If we fail and in so doing destroy the only abutments we have through tooth discoloration, paradental injury or pulp destruction, our failure is failure indeed. If by conservative cutting, we have lustrous teeth with a good periodontium and vital pulps, there is hope, and the patient may have a chance, if not with us, with his next dentist, who should be thankful that, in our failure, there was left a prospect of success.

If err we must, let it be on the side of safety. If our error is on the radical side, the next dentist consulted may be the exodontist.

In order to avoid possible injury to the approximating tooth and not overcut the abutment tooth, it is wise to begin the cutting with lighting strips, stripping off the contact of the abutment tooth. Soon, we are able to pass a garnet sandpaper disk freely between the teeth. The tooth is kept dry with the cold air blast and the reduction continued by intermittent cutting, the disk being held slightly inclined to the axial on the lingual side. The lingual surface is reduced with small mounted and inverted cone-shaped carborundum stones, with the most liberal cutting near the gingival. It is at this point that we desire the greatest bulk of gold, as it will not cause occlusal interference, and cutting here will not endanger the pulp nor discolor our tooth. Very light cutting is done on the middle and incisal thirds. It is better to trim off the incisal edges of the lower teeth to clear the occlusion rather than to cut too much at these points. Before we reach the incisal edge, a small sharp knife-edge stone is run along the lingual incisal enamel edge, but never undermining the labial enamel. A bevel may be carried onto the incisal edge of the labial enamel plate, but never over it. With this knife-edge stone, a tiny cut is made across the incisal edge at the dento-enamel junction of the lingual enamel plate, not so much to increase retention as to add gold at this vulnerable point. To complete the proximal surfaces a small tapering fissure bur, No. 00, is held in the direct hand-piece parallel with the long axis of the crown, and a cut is made through the enamel and slightly into the dentin. If the bur is moved up and down, the effect of the cross-cuts are lost, and a smooth tapering groove will be made. The cut must be lingual to the labial enamel plate and lingual to the mesial and distal incisal angles. If the cut bisects the angle, it will undermine the enamel. The grooves are made as nearly parallel as possible by cutting a little in one and then in the other with

the eyes looking parallel to the long axis. (Fig. 12.)

The retention of the casting on the tooth is a matter of a few simple principles. First, there must be sufficient gold to withstand the stress without springing. In most cases, more gold is used than is necessary. The length of the tooth crown is a strong factor. It

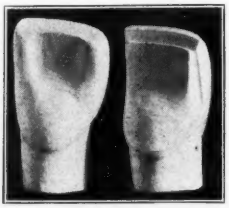

Fig. 12.—Parallel grooves.

is obvious that the longer the tooth, the better the opportunity for retention. The two most vital principles involved are the parallelism of the opposing mesial and distal walls and grooves and

Fig. 13.—Casts showing simple, half-round cuts where little retention is needed.

the form of the grooves. The opposing walls must be almost parallel with each other. It would be ideal if they could be machined so as to be absolutely parallel, but since that cannot be done, we must make them only sufficiently sloping toward the incisal to allow the castings to go to place without spreading. They should fit with such accuracy that the cement is only necessary to seal the margins. In short bridges, the simple half-round cuts made by the burs are described as sufficient. (Fig. 13.) Where greater retention is required, it may be secured by the simple plan of taking small short hoes and changing the rounded form of the grooves to rectangles, widening

Fig. 14.—Casts showing altered cuts (compare Figure 13) intended to meet need for greater retention.

them very slightly at the incisal. A few strokes of the little sharp hoes and the trick is done. (Fig. 14.) This is not required except where the greatest possible retention is desired with the minimum of cutting, together with the minimum amount of gold. We think that it is apparent how the little rectangular groove with its square walls offers a greater resistance to torsion than rounded grooves. It acts like the flat seat of a cavity in that it offers resistance at nearly right angles to lines of stress.

Figure 15 shows a bridge attached to the left cuspid. The point of the cusp is not touched. There is no gold over

the lingual surface of the cusp end. No gold is in view except a very little on the mesial surface just labially to the contact. This is so small that it did not show in the photograph. Figure 24 shows the labial view with black compound placed to represent the gold casting, and also the lingual view of the preparation.

In his "Operative Dentistry," volume 2, Dr. Black devotes pages 115 to 123 inclusive to the subject of abrasion of the teeth. He had given much study

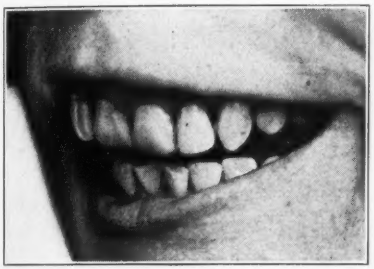

Fig. 15.—Bridge attached to left cuspid.

to this subject and in his masterly manner gives us the results of his observations. Read this chapter again. He closes with these words: "Dentists will do well to prevent such cases rather than attempt to cure them."

Most of these cases have gone untreated, and where treatment was instituted, the cutting has been of a radical nature. With the idea of preventing these cases, at least in a measure, and with very little cutting, we suggest what we have termed the protective filling. Figure 16 shows a number of extracted teeth in which abrasion has progressed to the dentin. After the dentin is reached there is evidently an erosion, beginning, in most cases, to cup out a small concavity. The direction of the enamel rods is such that the short undermined rods around the margin fall away as the abrasion and erosion progress and the teeth more and more rapidly wear away. Figure 17 shows a cross-section drawing of an upper bicuspid indicating the direction of the enamel rods. Figure 18 shows the buccal cusp worn until the point of the dentin is exposed with usual concavity. Figure 19 shows the first step in the preparation of the cavity. A square end, plain fissure bur, slightly smaller than the area of exposed dentin, is directed into the dentin at an angle, as

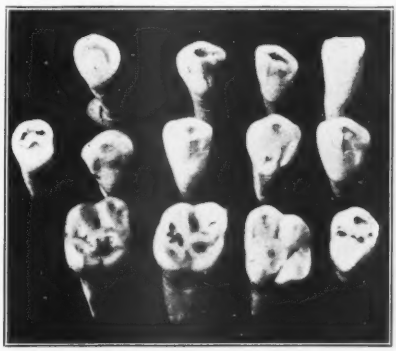

Fig. 16.—Extracted teeth in which abrasion has progressed to the dentin.

shown in the drawing. It should be carried deep enough to secure retention, which must be controlled by the judgment of the operator in each case.

The next step is shown in Figure 20. With a round bur, a countersink is made, extending slightly into the enamel margin. The cavity is now completed and ready to be filled. I make no undercuts and have found them to be unnecessary. The gripping of the dentin on the gold is sufficient to hold the filling. I do not, as a rule, use undercuts; never, if the cavity is greater in depth than in width. If the cavity is very shallow, it is wise to use slight undercuts. Amal-

gam or silicates in this cavity would be worse than no filling at all. Some have suggested cast gold inlays, and since I have never tried them, I should consider a cemented margin contraindicated at this place. After using cohesive gold foil for many years and observing the results, I consider it ideal and can recommend it as highly successful. Figure 21 shows a cross-section of the filling.

Of course, no effort is made to re-

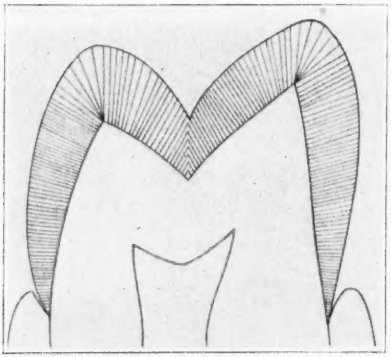

Fig. 17.—Cross-section drawing of an upper bicuspid, indicating the direction of the enamel rods.

store the lost cusp or open the bite but the filling is finished flush with the enamel. (Fig. 21.) The gold must be added in small pellets and thoroughly condensed with a small plugger point. It if is not thoroughly condensed, it will become pitted and not resist wear, and will be worse than no filling at all. The majority of patients over 30 years of age need this service, and years of wear may be added to their dentures by this simple procedure. It greatly delays the closing of the bite through wear, and I certainly need offer no argument regarding the ill-effects of the closing of the bite. After years, these fillings will wear down, until they must be renewed, but after practicing this method for twenty years, I have found it necessary to make but few renewals.

If the dentin wears smooth and flat, a filling is not indicated. Only those

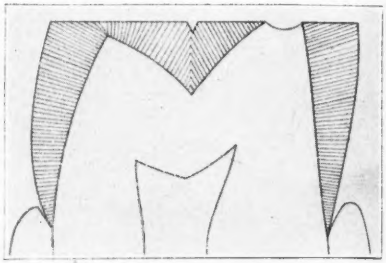

Fig. 18.—Buccal cusp worn until the point of the dentin is exposed, with usual concavity.

which cup out and present a concavity should be filled, and they should be filled when they first appear and while they are small.

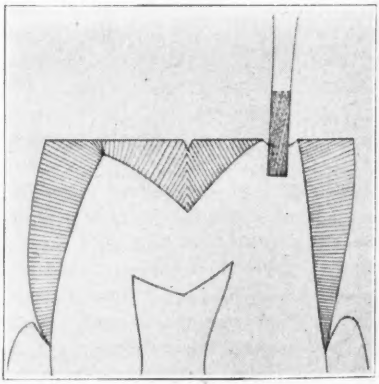

Fig. 19.—First step in preparation of the cavity.

In order that we can do this important and particular work well, we must see well. It is highly necessary that we

use the Beebe binocular loupes. (Fig. 22.) They are of great assistance in the preparation of cavities, examination of impressions and wax patterns and the final fitting and finishing of castings on the teeth. We must not only see well to prepare small delicate cavities and fill them, ever watching every part of our work, but we must also have small instruments; small sharp burs, small stones, small sharp cutting instruments. Instruments have been made too big and clumsy. With them, we could do

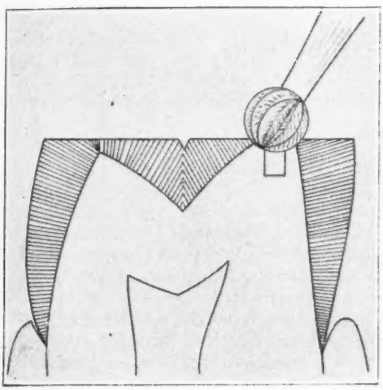

Fig. 20.—Second step in preparation of cavity.

nothing but cut large cavities. C. E. Woodbury has done a great service in giving us a fine set of instruments of reduced size. Still more will be done along this line. The 000 round and inverted cone burs as well as other smaller forms have been a great aid.

Do not throw away your broken instruments. Many of them may be formed into splendid small hoes and hatchets, just the instrument for these small cavities. With a heatless stone, we can soon reform them and, with a disk, polish them. When honed on a stone, they will serve better than anything we can buy for special purposes.

Once again I wish to stress the use of the rubber dam. It offers protection to both patient and operator. Cavities may be prepared under the rubber dam with more accuracy, with less danger to the dental pulp and, by reason of the dryness, with less pain to the patient. The dam should be applied and the cavities thoroughly cleaned by both mechanical and medicinal agents before inlays are cemented to place.

Once more I urge that care be taken

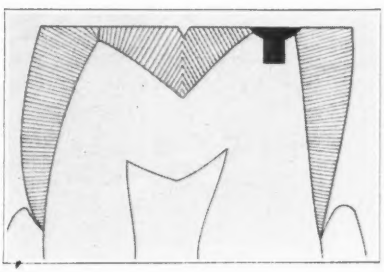

Fig. 21.—Cross-section of filling, finished flush with the enamel.

not to injure the septal and gingival tissue. How often we see beautiful operations underneath which are lacerated, injured, suppurating and bleeding gingivae. There will be enough injury when we exercise all the care that we are capable of.

Do not pass the ligature carelessly. Do not ligate teeth except when compelled to do so, and that will be rarely. Do not pack amalgam into the interproximal spaces. Be careful with finishing strips.

I commend you again to the great work of Black. That you may refresh your memory, read what he says on this subject on page 145, volume 2, of his "Operative Dentistry." He observed that men in his day were doing what we

are prone to do now in cutting the teeth more than the case requires.

DISCUSSION

H. E. Friesell, Pittsburgh, Pa.: Dr. Prime not only read the paper but made his own discussion for us. The matter of basic importance in the presentation of this paper is the directing of the operator's attention to the fact that the filling of the cavity or the restoring of lost tooth structure, whether it be by a filling or the three-quarter crown, is something more than stuffing gold in the hole or cementing a patch on a tooth or half-soling the occlusal surface. Developments in recent years in the mechanical phases of soldering and casting and in the use of anesthetics have entirely overcome the sensitiveness of the tooth structure while

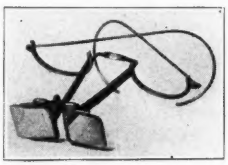

Fig. 22.—Binocular loupes.

the operations are being properly finished and have a great tendency to induce many operators to look on these operations in tooth structure as if they were purely a type of tinkering or carpenter work. The tooth does not hurt, the patient does not complain and the operator is too prone to concentrate all his attention on the finished piece of jewelry he is going to put on the tooth, forgetting that the tooth that is anesthetized will become sensitive again when the effect of the anesthetic has passed off; forgetting, or perhaps not realizing, that, even though the patient does not feel pain at the time, excessive cutting of tooth structure will expose the vital structures of the tooth in a way that Nature has not expected them to be exposed. Lack of sensitiveness in operations performed under anesthesia often misleads operators, who thereupon concentrate on the purely mechanical phase of the operation and cut the tooth indiscriminately and rapidly, and, in so doing, may readily bring about an irreparable injury to the pulp through the dental fibrils by overheating. Heat, we know, destroys albumin, destroys living tissue or so injures it that it dies, and yet we take a stone disk and because the patient does not feel it at the time, we practically fry or boil the living tissues in that tooth. Naturally, when the effect of the anesthetic passes away, the living tissues will protest against the injury that they have suffered. Dr. Prime also emphasized the need for the operator considering more than just how expensive an appliance he can "sell the patient." What difference does it make if we do place a complicated

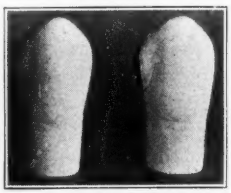

Fig. 23.—Labial view of cavity filled with black compound.

piece of skilfully made jewelry on a tooth if, after it has been placed, the tooth is of little use to the patient? We must go back to fundamentals. We must understand that when Nature made dentin and gave it its peculiar properties, it was for the purpose of protection against conditions to which teeth are subjected; that when Nature made enamel, she did so to protect against other conditions; that when through disease the

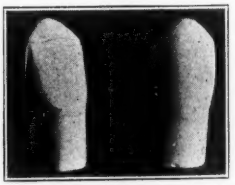

Fig. 24.—Labial view with black compound placed to represent gold casting, and lingual view of preparation.

enamel or dentin is lost, the dentist's problem is not simply a question of making a base or a cavity or a support for an appliance and getting the appliance to stick there, but of making this restoration in such a way that the physiologic functions of the tooth are

restored as an organ or part of the masticating organ, and second, the restoration of the tissues themselves, the dentin and the enamel, and the conservation of the living part of the dentin and of the pulp. I refer to the principles that Black elaborated. It is well that at all times, we who are doing operative dentistry, remember these first principles. Do not forget that a tooth is a live organ even though the pulp may have been removed, and that it is part of the dental organ—the masticating organ. It is not an isolated cog but a part of that organ which is so essential for mastication if the rest of the body is to be maintained in proper function. This should be emphasized and reiterated because the great tendency, through ease of operating and through advanced technic, of many of us is to think more of the technical side of our operations than of the real purpose for which those operations are made. Before the gold inlay era and that of the three-quarter crown, conservation of tooth structure was frequently used as an argument for inadequate operations. The development of the inlay, *seeming* to promise an easy way, led to extravagant cutting away of good enamel and dentin to permit the operator to do an "easier" piece of work. Procain has made cutting to the point of mutilation possible. The need for considering the physiologic and physical principles as well as the technical is becoming more and more apparent.

Arthur R. McDowell, San Francisco, Calif.: The conservation of tooth structure; vitality of the pulp and the investing soft tissues of the teeth is fundamental to the preservation of our nation's teeth. I quite agree with Dr. Prime in his statements regarding excessive and unnecessary cutting of tooth structure and tissue abuses by the use of procain, which while an invaluable aid to good operative dentistry in the hands of one who has knowledge of vital tissues and an appreciation of the importance of pulp conservation, has undoubtedly aided and abetted too extensive cutting through lack of judgment of many operators. Dr. Prime is making a plea for preventive dentistry, even to a greater degree than our profession has been accustomed. In this presentation, let us be reminded that Dr. Prime, in his cavity preparation, is presenting the minimum of excavation necessary to place a serviceable filling. The illustrations shown by Dr. Prime tell the story—a plea for conservatism still beyond the principles of present-day procedure. We note a sharp deviation in outline form from the accustomed parallel walls on the proximal surface and the narrow occlusal step in Class II illustrations. Our attention is held by the departure in the use of cohesive foil exclusively in the proximal portion of this style of cavity preparation to the exclusion of noncohesive foil long advocated in this situation for the conventional Class II type. Retention and resistance form is excellent, but I raise a question on convenience form (or access form such as some operators use) in the cavity preparation, and placing and condensing cohesive foil at the buccogingival and linguogingival line angles, working through such a small opening of the proximo-occlusal, presuming that a proximal tooth is present. Dr. Prime speaks pertinently of tooth conservation in the preparation for a three-quarter crown. Here, even more than in cavity preparation, the plea for conservatism of tooth structure directly applies in more ways than one. Only sufficient cutting to afford a "veneer" is required for the sake of esthetics, comfort of the patient and preservation of the pulp. After two decades of experience in the treatment of abrasion, we are fortunate to have the results of Dr. Prime's observations. Occlusal wear, to the depth of sensitive dentin, even to exposure of pulpal horns, is not infrequent, and it is a well known fact that otherwise good dentures are wrecked by the closure of the bite through occlusal wear. It is important to emphasize this part of the paper, heeding the particular type of cavity preparation and well condensed cohesive gold foil filling advocated by Dr. Prime, and remembering to look for abrasion in its incipiency for the best results. Dr. Prime has voiced the necessity of detail, which we know is so essential. "A chain is no stronger than its weakest link" is an oft repeated truism. Good vision is a prerequisite in a dental operation. Sharp instruments and burs are essential; rubber dam application and a high regard for the septal and gingival tissue should hold the constant attention of every operator. If it would conserve the teeth of a nation, the dental profession must preserve the investing tissue of the teeth—particularly the extra-alveolar soft tissue group of fibers, so frequently allowed to be injured needlessly and thought-

lessly by many dental operators. These injuries are quite often permanent, and it is timely that Dr. Prime has voiced a warning.

Dr. Prime (closing): Regarding the mesioclusal cavity in the upper first bicuspid to which Dr. McDowell refers, I grant that it is just a little bit inaccessible. We should be careful in cutting for convenience only. We may be justified in using a mechanical separator in special cases rather than doing too much cutting for convenience. With special instruments and proceeding slowly, we have no difficulty with this cavity. Let us remember that we are operating on living tissues. We have had our eyes riveted on the roots of teeth. Let us take our eyes off the apical end of the roots and focus them on the crowns, where the trouble begins.

SETTING UP THE FULL DENTURE*

By R. H. KINGERY, B.S., D.D.S., Ann Arbor, Mich.

IF you will consider, for an instant, the literature on the arrangement of teeth in artificial denture construction, you will find that it is as old as full denture prosthesis; in fact, as old as dentistry itself. The earliest examples of prosthetic procedures consisted of the replacing of lost teeth and involved the arrangement or the setting up of the teeth. If we will but compare one of the very common sets of so-called "store" teeth with one of those ancient museum pieces in which ivory blocks were used, we cannot but admit that there is a marked resemblance in the arrangement of the teeth. The only difference is that the modern case has teeth of superior form and construction.

From time to time, we hear rumblings regarding standardization in technic and construction, the complaint often being heard that there are so many conflicting opinions that the conscientious practitioner, rather than being aided, is left in a maze of confusion. This criticism has some foundation, and I agree that we would advance more rapidly with cooperative thinking and endeavor than we ever can with individual pet theories and mysterious technics. Standardization, however, is least to be desired in setting up teeth in the full denture. The great amount of individual variation of facial components not only prohibits a standard set-up, but also demands variation for each individual case.

There are numerous methods of arranging teeth for securing the desired mechanical features, such as balance and contact. There is no technic—in fact, there can be none—which always gives the best esthetic results. These results depend entirely on the ability of the operator, each individual case presenting a different problem. I can think of no place in dentistry where the personal equation or artistic individuality of the operator is so plainly expressed as in the arrangement of the teeth in the full denture. Just as the artist makes a minute study of each setting that he attempts to paint, so must we make a study of the peculiarities of facial contour and expression in each patient. The patient of the dentist who arranges all his cases alike may be complimented by the statement that his or her plate looks nice; while the patient of a dentist who,

*Read before the Section on Full Dentures at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

after a careful study, uses his artistic ability in arranging the teeth will receive the compliment, "Why, I did not know that you were wearing dentures." I think that our goal, from the standpoint of esthetics, should be to produce a case which will escape detection rather than merely an artificial set of teeth. I fully realize that we are not all gifted with artistic ability. However, all of us, by studying our cases, spending more time and thought on our arrangement, checking and rearranging at the try-in stage, in other words, by inserting an individual touch to each case, will obtain results which are greatly appreciated by the patient and will receive a great amount of personal satisfaction.

While mechanical principles of tooth arrangement have been given to you many times, a brief review of these points will not be out of place in this paper. In spite of all our efforts, the skeleton-in-the-closet in full denture work is the mandibular case. The occlusion of the two cases will help more to keep the mandibular case in position than many of the so-called trick technics for their retention. Mandibular teeth should always be set close enough to the ridge to insure stability. One is inclined to listen to the common plea of the patient, "I don't want to show my upper teeth"; which results in increasing the height of the mandibular teeth to preserve the vertical dimension. This not only increases instability but makes the mandibular teeth more plainly visible than the maxillary teeth. In ordinary speech, this is not desirable. The position of the mandibular teeth, except in unusual cases, should be over the crest of the ridge. In the crushing of food particles, the force comes between the inclined planes of the lingual cusps of the maxillary teeth and the inclined planes of the buccal cusps of the mandibular teeth. The mandibular teeth should be so placed that this line of force comes directly over the crest of the ridge. In nearly every instance, the maxillary teeth are placed in such a position as will bring the mandibular teeth in the right relation to the ridge. When we encounter those cases which have a large mandible with a very small maxilla, we resort to the crossing of the bite. This is accomplished by the use of cross-bite teeth or so-called channel teeth, the latter brought out by Dr. Sears, or by the use of ordinary posterior teeth, the maxillary right teeth being placed on the mandibular left and maxillary left on the mandibular right. The mandibular teeth are alternated on the maxillary case in the same way, with the exception that the mandibular first bicuspid is left out; this making three posterior teeth on the maxillary case.

Relation of the teeth to the ridge is not our only problem in the proper mechanical arrangement of the set-up. The protrusive and lateral movements of the mandible necessitate not only a lateral but also an anteroposterior curve to the arrangement of the teeth. A denture having teeth arranged with a straight occlusal plane, in most instances has little balancing range of movement. The anteroposterior curve is developed mainly in the molar region, the distal of the first molar being raised, and this inclination increased in the second molar to a point where a curve is established paralleling the curve or inclination of the condyle path in the case which we are setting up. One must bear in mind the direct relation which the overlap of the maxillary incisors on the mandibular incisors has on this curve. It is plainly seen that a deep overlap would necessarily increase the curve in order to maintain balance.

It is for this reason that I recommend either setting the lower anterior teeth last or adjusting them finally after the proper curve is established in the posterior teeth.

Besides maintaining a balance in the incising or protrusive relation, the teeth must be so arranged that contact or balance is present on the opposite side from which the patient is masticating, or on the so-called working side. In the working relation, the buccal cusps are interdigitated, the movement of the teeth back to a position of rest being nearly at right angles to the median line. The maxillary molars are arranged with the long axes diverging slightly outward to oppose with the mandibular molars, which converge inward. By a slight adjustment of the teeth, with the articulator held in the various lateral positions, this balance is established. It is often necessary to grind the teeth slightly, deepening the sulci, marginal ridges, etc. This is accomplished best with a finely cut small inverted cone stone.

I have passed over the mechanical aspects of balancing and occluding the teeth in rather brief fashion, as it is, at best, a repetition of an old story, the details of which, when stated in a paper, are confusing.

While the esthetic phase of full denture work has been well presented by Dr. Bruening, I should like to show the close relationship which exists between esthetics and the arrangement of the teeth. Esthetics or beauty in dentures involves selection, color combinations, etc. This knowledge and care may go for naught if close attention is not given to the arrangement of these carefully selected teeth. Carrying out the type of arrangement to which the individual has been accustomed, in other words, imitating the arrangement of the individual's lost dentition (I am considering the anterior teeth), has a great influence in restoring the confidence of the patient in his personal appearance, which is very important. This last statement should be qualified, as it is possible to overdo the variations in arrangement by having too great a lap one over another. If overlapping is carried to extremes or is accentuated, with our present artificial teeth, we decrease the naturalness rather than increase it. The point I am trying to make is that we should put forth a conscientious effort with the materials which we have to place the teeth in as nearly a natural position as is possible for the individual patient.

Records of the patient's own teeth before extraction are invaluable aids at the time of full denture construction. These records will give all the peculiarities in arrangement which, with a little care and imitative skill, can be duplicated in setting up, especially the anterior teeth. I firmly believe that the importance of these records should be impressed on our patients. Too many patients come to the prosthetist edentulous, never having heard that a record of their own dentition would have been of utmost value as an aid in the construction of an artistic denture.

The position of the central incisor is important to preservation of the contour of the upper lip. Too great a lingual or buccal inclination of these teeth gives a very displeasing effect. The incisors present innumerable opportunities for variations, such as lapping, depressing and tilting. This is true not only of the maxillary but also of the mandibular incisors, which almost demand a variation from a straight line arrangement to obviate the artificial appearance so common in the anterior teeth of mandibular cases. The cuspid, which is one of the

most important teeth in the set-up, forms the corner of the arch and greatly influences the character and appearance of the case. The neck is left prominent, this aiding in the reproduction of the cuspid eminence. The tooth is rotated enough so that two-thirds of the labial surface falls in line and becomes a part of the posteriors, the remaining third being the main part which shows in a direct front view of the case. The proper position of the cuspid is one of the factors which tend to prevent the dropping or settling of the tissues, so often seen in the region of the corner of the mouth.

The type of arch is mainly determined by the anterior teeth. While in the square, broad face, the anterior teeth approach more nearly a straight line, there is a too common tendency to arrange the anterior teeth in all types with too little a curve. Especially in the more tapering faces, if there is too straight an arrangement of the anterior teeth, we have a flattening of the lip. The fulcrum of the lip is ironed out; which results in what the layman designates as a plate face. Consequently, in the tapering types which we meet so frequently, the central incisors should be prominent, the lateral incisors and cuspids falling away in a gentle curve, preserving the normal contour of the lip and preventing the loss of the fulcrum which, when present, is not noticed, but is made conspicuous by its absence.

One could suggest innumerable possibilities in the arrangement of the twelve anterior teeth. There is one about which I should like to speak, and that is the amount of overbite, overjet or whatever term you wish to use. Not only do the mechanical requirements call for placing the mandibular anterior teeth on the ridge, but the appearance also demands this arrangement. It is not uncommon to find quite a protrusion of the maxilla or retrusion of the mandible. Many dentists apparently fear to set the anteriors in these cases with an overjet or to set the maxillary teeth in a marked anterior relation to the mandibular teeth. These cases should be set with an overjet, not only, as I have said, for mechanical efficiency, but for appearance as well. Failure to do so gives the appearance of a thick or swollen lower lip and a pseudoprotrusion of the mandible.

In considering speech habits, I shall merely attempt to bring attention to the close relationship existing between the position of the teeth in the full denture and the lips and tongue in speech function. I say call attention, for, with the exception of Drs. Peters, Lowery,[1] Tench,[2] Wright,[3] and others whose works have aided me, few have written on this subject. One has but to carry on a conversation with some patients to realize that some knowledge of phonetics could be used in full denture work and, I might add, in bridgework as well.

Many organs and factors enter into the production of speech; but, as I have said, I wish to mention only the importance of proper arrangement of the teeth as an aid in speech production.

While the tongue fills the cavity bounded by the teeth, the functioning portion in speech is above the mandibular teeth. For this reason, the teeth in the mandibular case should be set low or

1. Lowery, P. C.: Selection of Artificial Teeth for Prosthetic Restorations, J. N. D. A., 7: 611 (July) 1920; Art and Esthetics as Applied to Prosthetics, Dent. Cosmos, 63: 1223 (Dec.) 1921.

2. Tench, R. W.: Influence of Speech Habits on the Design of Full Artificial Dentures, J. A. D. A., 14: 644 (April) 1927.

3. Wright, M. H.: Simplified Phonetic Tests (unpublished data).

close enough to the ridge to prevent interference.

The lower lip makes light contact with the incisal edge of the maxillary incisors in words beginning with f and v, such as "fan" and "valve." This aids us in determining the length and position of the maxillary teeth.

The tongue, in pronouncing t's and d's (as in "to" and "do") makes contact with the lingual of the maxillary incisors at the gingival portions, while in pronouncing the "th" sound, as in "thick," there is light contact between the tip of the tongue and the incisal edges of the maxillary and mandibular incisors. Here again, we have some check on the anterior arrangement of these teeth. If the incisors are not placed far enough anteriorly, the h in "thick" is not distinct, and, also, the edge of the tongue may show signs of projecting slightly beyond the incisal edge.

If the arrangement of the teeth causes too narrow an arch, the tongue is crowded or bunched, which results in thick-tongued speech. Again, especially in the bicuspid region, if the lingual space is too wide, the air slides by the tongue, which results in one of the causes of whistling, particularly apparent in words ending in d's, t's, etc., as in "needs" and "prevents." It will also be seen from the foregoing that the arrangement of teeth should be fairly symmetrical, as otherwise, the tongue may not be able to compensate for the side diverging the most from the median line.

It has been my purpose in this paper to show that the arrangement of the teeth is an important step in full denture construction. Proper arrangement not only influences mechanical efficiency but appearance and speech habits as well. No one can deny that poor appearance and speech impediment often influence the mental attitude of the patient to the extent of defeating the success of the denture. This can be avoided by the proper arrangement of carefully selected teeth.

More care in the arrangement of the teeth will greatly increase the success and satisfaction of our denture service.

INHERITED AND CONGENITAL CAUSATIVE FACTORS IN MALOCCLUSION*

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THERE are recorded some historical data which would indicate that malocclusion or irregularity of the teeth was observed about 400 or 500 B. C.; ever since which time men have been speculating in regard to the hereditary and congenital influences on such conditions. At various times during certain periods, the question has been actively discussed, and, from time to time, there have been articles published on the subject. None have been conclusive and most of them have been based upon theory rather than substantial evidence, the deductions usually being arrived at by speculation, rather than by the accumulation and analyzation of scientific data. Practically all of the direct evi-

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dence on the subject, from which deductions have been made, has been obtained by men who had the opportunity of but a limited clinical experience and observation, and who, unfortunately, were possessed of only meager scientific attainments. It seems perfectly obvious, then, why opinions have been so greatly at variance. In many instances, men considered of equal authoritative ability have arrived at conclusions which were diametrically opposite. For instance, one of the questions which has been almost continuously discussed is whether or not progeny inherit the large teeth of one parent and the small jaws of the other and vice versa. Another question always debatable is whether or not the child inherits a specific type of malocclusion and deformity of the jaws, such as Class 2, Division 2, Angle classification. Many biologists are, I believe, inclined to favor the theory of direct inheritance, while nonlaboratory investigators, those who have made clinical observations, are still skeptical. The old traditional pendulum has surely had its innings, first swinging in favor, then swinging against, certain propounded and not infrequently widely advertised theories. The fallacy of some of the highly touted deductions and dogmatic conclusions is perfectly obvious. The intricacies involved and the difficulties encountered in the study of hereditary influences on the human dentures are so many that the problem becomes a most complex one. The fact that the study and observation has to extend through several generations with an unbroken continuity, both of subjects and investigators, adds greatly to the complexity of the problem and almost precluded the possibility of ever solving it absolutely. However, one cannot fail to realize that its solution might have been much further advanced had there been, for many years past, a concerted effort on the part of the orthodontists in collaboration with the biologists in the accumulation of reliable evidence for mutual consideration and scientific analysis.

The approach to this subject is a difficult one but, in the light of present knowledge, there are certain things on which all may agree: inheritance is absolutely necessary; life is not spontaneous and must be propagated and perpetuated through and by the living cell, environment being a concomitant and necessary factor for its existence; there are more born than can possibly live, there always being some lethal agent present to destroy the more unfortunate, so that it would seem that the law of the survival of the fittest might be accepted without much persuasion. Perhaps no one will dispute the fact that when the ovum is pierced by the sperm (two living cells) and the phenomenon of fertilization takes place and a new life begins, this minute miscroscopic organism will possess all of the potential inherited possibilities for the complete development and growth of this particular individual. The inherited morphologic and physiologic structure into which it will grow is predetermined; the complete architectural design has been fixed; the die has been cast. There will not be the slightest change: every minute cell, every structure, every organ, every character, every trait will be produced in the finished product, positively and in accordance to form and design and on scheduled time. This will occur notwithstanding the fact that the germ cells are living cells with typical cell structures and functions, but with none of the parts of the mature organism into which they later develop. All of this complex intricate and mysterious phenomenon will occur provided, *provided,* I repeat, the organism lives

and develops in a favorable and proper environment. These facts are significant indeed and because of them the ever enduring and perpetual discussion and investigation of the relative merits of heredity and environment will be promulgated. The biologic science may never know the exact character of the morphologic or physiologic design that has been cast in an individual case, or the direct effect of environment on such an organism, but it is certain of the fact that heredity must be first and environment come afterwards, that they are inseparable, and that, in turn, each asserts its own influence one on the other.

In the consideration of orthodontic problems as concerns hereditary influences, I do not believe that we think often enough of the beginning of the life of an individual or the complexities involved in its development. We are strongly inclined to make comparisons between the parent and child by casual observation, and arrive at some conclusion or make our deductions upon a flimsy and unscientific hypothesis. Before passing judgment, one must come to realize the value of the knowledge of the biologic sciences which has clearly explained to us the phenomena of life and its mechanism of development and growth. Conklin gives a graphic description of the creation of a new individual. He writes as follows:

> In by far the larger number of animal species the oosperm, (the fusion of egg and sperm), either just before or shortly after fertilization, is set free to begin its own individual existence, and in such cases it is perfectly clear that the fertilization of the egg marks the beginning of the new individual. In all cases, the new individual is always distinguishable from the body of the mother, since there is no protoplasmic connection between the two. In mammals generally, including also the human species, not a strand of protoplasm, not a nerve fiber, not a blood vessel passes over from the mother to the embryo; the latter is from the moment of fertilization onward a distinct individual with particular individual characteristics. The fertilized egg of a star-fish or frog or man is not a different individual from the adult form into which it develops, rather it is a star-fish or frog, or a human being in the one-celled stage. This fertilized egg fuses with no other cells, it takes into itself no living substance, but manufactures its own protoplasm from food substances; it receives food and oxygen from without and it gives out carbonic acid and other waste products; it is sensitive to certain alterations in the environment such as thermal, chemical and electrical changes—it is, in short, a distinct living thing, an individual or person. Under proper environmental conditions this fertilized egg cell develops, step by step, without the addition of anything from the outside except food, water, oxygen, and such other raw materials as are necessary to the life of any adult animal, into the immensely complex body of a star-fish, a frog, or a man. At the same time, from the relatively simple reactions and activities of the fertilized egg there develop, step by step, without the addition of anything from without except raw materials and environmental stimuli, the multifarious activities, reactions, instincts, habits, and intelligence of the mature animal. Is not this miracle of development more wonderful than any possible miracle of creation? And yet as one watches this marvelous process by which the fertilized egg grows into the embryo, and this into the adult, each step appears relatively simple, each perceptible change is minute; but the changes are innumerable and unceasing and in the end they accomplish this miracle of transforming the fertilized egg-cell into the fish or frog or man.

Obviously, everything which is to be inherited, every hereditary tendency, every character, trait, structure is contained within the confines of this minute living organism. In man, this transformation extends over a long period of time; the development and growth and maturation of the cells is subjected to many and varied extrinsic factors, many of which exert a modifying influence on the intrinsic or inherited ones. One of

the most important and interesting things, as well, is the mechanism by which inheritance is carried on. The first thing to occur in development after fertilization is the cleavage or division of the egg; a process known as mitosis. This process is continuous until the full complement of cells have been created; that is to say, until enough cells have been manufactured for the complete development of the individual. There is contained within the substance of every cell, both body cells and germ cells, a definite number (in man, forty-eight) of small bodies called chromosomes. Professor Morgan claims to have proved that the chromosomes are the sole bearers of heredity. Since the germ cells or reproductive cells, both male and female, are provided with chromosomes in a definite number (forty-eight), which is always constant, it follows that the progeny receives exactly one-half of its inheritance from one parent and one-half from the other. To avoid the occurrence of an overabundance of chromosomes (ninety-six), forty-eight from the ovum and forty-eight from the sperm, which might result in a monstrosity or something akin to it, when the egg and sperm are about to unite in fertilization, a remarkable phenomenon, called "reduction division," occurs, by which one-half of the chromosomes in each cell are eliminated. The mechanism of this process consists in a collection of the chromosomes at the equator of the cell as usual, but instead of splitting in halves, they separate, half of them moving to each end of the cell, after which the cell membrane contracts between them, leaving twenty-four chromosomes, or one-half the usual number, in each. These reduced cells are called gametes. The union of the male and female gamete is known as a zygote or oosperm and is the beginning of the life of a new and distinct individual. At the time the "reduction division" of the cells occur, it is supposed that an important and remarkable series of events take place, which is highly significant from an hereditary point of view. This process is vividly described by Dr. Wiggam.

It is just at this point, no doubt, that the segregation of the Mendelian factors takes place so that the characters from them will be distributed properly among the offspring. This is brought about by the fact that when the entire set of chromosomes are collected at the equator of the cell and begin to migrate some to one end and some to the other end of the cell, it is a mere matter of chance, like the shaking of dice, which end of the cell it shall be toward which any particular chromosomes shall migrate. However, since the factors are believed to exist in pairs, one for the dominant character and one for the recessive character, it is also believed that the two factors of any pair are situated in different chromosomes. Now since half the chromosomes go to one end and half to the other, it is evident that it is a mere matter of chance where the chromosome which contains the dominant or recessive factor of any pair goes, let us say to the east or to the west end of the cell. Since an organism can get along quite well, whether it receives the dominant or the recessive factor of any pair, it is evident that this half set of chromosomes when united with the cell from the opposite sex, also now containing its half set, is quite sufficient for the growth and development of a complete individual. While it is true that, in the reduction divisions, half the heredity is thrown out, yet a complete set of factors remains, sufficient for perfect development. While the determiners do exist in pairs, yet the dominant factors are not all located in one set of chromosomes and the recessive factors in the other set of chromosomes. In the peas for instance, the factor for tallness, which is dominant, may be located in the same chromosomes as the factor for green color, which is a recessive. Each chromosome contains a great many both dominant and recessive factors, but the members of any particular pair of factors are believed always to be located in different chromosomes. One readily sees that in the chromosomes which are left out in the reduction divisions, the

result is that many of the hereditary characters of the ancestors are lost, or at least will be absent from the particular individual who is to be born from any particular cell.

A still better understanding of the function of the chromosomes may be had by quoting further from the writings of Dr. Wiggam.

In the chromosomes are stored the factors or determiners. The chromosomes in the body-cells, which originated of course from the first cell from which the individual was born, determine one's life characteristics, such as height, weight, form, color, nervous organization, temperament, intelligence and the like. The chromosomes in the reproductive cells, such as the eggs of birds or germ-cells of higher animals, carry all these characteristics on in the line of heredity and hand them to the children. Chromosomes are, therefore, as Woods has said, "the most important things for their size in the whole world." They control the inborn tendencies of the growth and development of the body and brain; while on the other hand, those which are set aside in the germ-cells for reproduction, carry the inborn health and weakness, sanity and foolishness of the parents, grandparents and other ancestors down the stream of the generations. Since, as Professor Morgan says, chromosomes are the sole bearers of heredity, it is evident that the qualities, that is, the factors or determiners for these qualities, which are carried in the chromosomes of the two parents and which are united into one cell at the time of sex union, determine all the natural characteristics of the children. They determine absolutely whether the children shall be naturally long- or short-lived, naturally healthy or unhealthy, naturally good or bad, wise or foolish. Environment, of course, influences to a considerable extent, the expression of these qualities, that is, which ones shall be fully developed and which ones shall remain dormant or be positively repressed; but a man's natural or inborn abilities, health, temper, temperament and character are determined by the sort of chromosomes from which he was born. . . . Each one of these tiny particles bears its own particular and individual burden of life as though it had been divinely appointed as the messenger of some Master Builder who had some purpose of His own hidden beyond human ken. Each cell carries its own burden of life from out the eternity of the past, and hands it on to the greater eternity of the future. The chromosomes in the cell carry, it may be, the life of an amoeba; the chromosomes in that cell bear within them all the mighty genius of a poet, a philosopher or a king. While they constantly vary and change, from causes and by processes of which we know but little, yet they are the most indestructible form of matter that we know.

The reader should understand that this stream of germ-cells is never broken. As I repeat many times, the germ-cells and body-cells are two separate systems of organization. When two cells unite from two parents to form a new being, they divide and grow to produce the new living individual. But in the higher plants and animals, a few cells are set aside at the beginning of each individual's life. These are the reproductive or sex cells. They remain unchanged, set aside in special organs until the individual comes to maturity when they begin to multiply and are by sex-union combined with a cell from some other individual and thus a new generation of individuals comes upon the scene. The plant or animal merely carries these germ-cells through life and adds nothing to them in so far as we know—except nourishment, and takes nothing away. It is evident then that heredity, the portion set aside for reproducing the next generations, is one continuous stream. The eggs or germ-cells which happen to be in any individual's body when it dies, of course die with it and decay; but before it has died, if it has any progeny, it has handed on to its offspring a portion of this hereditary material carried in these chromosomes, which it did not itself produce, but which it received from its parents, who in turn had received it from their parents back to the primal pair of living things. And so, on and on, this stream of germ-cells, which is the stream of life itself, flows unbroken throughout the succeeding generations. This stream of germ-cells is never broken unless a whole species is wiped away, and it will continue to flow on until the great drama of living things upon this earth is closed.

It seems certain indeed, if one is to accept the belief of the biologist, and there seems no other alternative, that the chromosomes carry all of the factors of

inheritance; that the germ-cells are immortal, and that any change in inheritance must be impressed on these cells. Furthermore, it seems almost as certain that the biologists will never agree on the mysterious process or phenomena by which such changes do occur. At this point, it seems logical to further clarify the following facts:

1. Life is perpetuated only by and through the action of the germ-cells.

2. Germ-cells are set aside in special organs at the beginning of each individual's life, after which they take no part or assume no responsibility in the further development and growth of that individual, but remain unchanged until the individual comes to maturity, when they begin to multiply and function.

3. The germ-cells contain none of the parts of the mature organism which develop and grow after they have combined by sex-union with some other individual.

4. There is contained within the substance of every cell, both body and germ-cells, a definite number of small bodies called chromosomes.

5. The chromosomes are the sole bearers of heredity. They carry determiners or factors or genes which are probably complex chemical substances, and which go in pairs and are designated by biologists as dominant and recessive factors. There are an indefinite number of pairs of factors or genes in each chromosome.

6. The function of the factors or genes is to produce in the individual that which is inherited.

7. When the "reduction division" occurs in the germ-cells just previous to fertilization, the chromosomes migrate some to one end of the cell and some to the other, without any particular selection or order, thus losing or conserving any hereditary characters which may by chance float to one end or the other end of the cell.

8. The determiners or factors or genes are believed to exist in pairs, one for the dominant character and one for the recessive character. It is also believed that the factors or genes of any pair are situated in different chromosomes, so, in the division of the chromosomes, it is quite uncertain as to which end of the cell those containing the dominant or those containing the recessive factors will go. Thus, by such a process of division, there may be lost a larger number of dominant factors in one individual and a larger number of recessive factors in another.

9. After the "reduction division," there are in the substance of each germ-cell, male and female, twenty-four chromosomes, making forty-eight in all. Therefore, by this phenomenon, the child gets exactly one-half of its inheritance from one parent and one-half from the other. However, the number of pairs of dominant and recessive characters received by any individual from either parent may and probably always does vary.

10. Any character, in fact, anything which is to be inherited, must be impressed on the chromatin of the germ-cells, since by and through the chromosomes only can any hereditary influence be transmitted.

11. Since the germ-cells form no structural part of the body, are highly specialized and located in special organs and do not function until the individual comes to maturity, it is reasonable to suppose that it would be extremely difficult, in fact, almost impossible, to impress any acquired character on them. Such change, if any, probably could not be induced until after the individual

came to maturity and the cells began to function.

12. Nature, in the beginning, provided almost an invariable stability of the germ-cells. Her purpose was unquestionably that they should pass down through generation after generation, reproducing always, as nearly as is possible, their like. Not in every particular but without any great variation, abundant evidence of such a purpose lies in the fact that the morphologic and physiologic structure has remained fundamentally the same since man was created.

As previously stated in this paper, the question of heredity is a most complex one. Any attempt to correlate, in its study, clinical observations with the many theories advanced soon engulfs one in a deep sea of mystery from which extrication seems almost impossible.

About the year 1800, Lamarck advanced the theory that the effect of use and disuse on the parts of animals is transmitted to their offspring, and that environment may produce changes in animals which are inherited by their progeny. Most biologists have abandoned this theory, but it is still held in respect by many less scientific persons. If the tenets of his proposition were true, many cases of malocclusion might be easily solved.

About the middle of the eighteenth century, Darwin proposed several theories to account for evolution, the chief of which was the law of natural selection, according to which, in the struggle for existence, it became the survival of the fittest, a law of the origin of species by the selection of favorable variations. While the process by which variations occur and the causes which produce them were not thoroughly nor satisfactorily explained by him, comparative recent investigations and laboratory experiments by biologists of good repute seem to strengthen this theory and prove that, in certain animals at least, "mutations" do occur, that such changes are passed on from generation to generation and that these mutations are produced by certain environmental conditions. When the orthodontists arrive at the place where scientific research can be inaugurated, such experiments as these may be of the utmost importance in solving some of our problems. The biologist, I understand, holds to the belief that the phenomena of nature will react in man in a manner quite similar to that noted in animals.

Late in the nineteenth century, Francis Galten, a cousin of Darwin, became interested in heredity and made quite an exhaustive study of quantitative traits in man. He attempted to establish certain principles of heredity by a study of statistics. He observed selected traits, such as genius or marked intellectual capacity, stature, eye color and disease. From these observations, there appeared to be established two main principles: (1) the law of ancestral inheritance and (2) the law of filial regression. By the first law, he anticipated, by mathematical calculation, the exact amount of inheritance each progeny would receive from its ancestors; namely, from the two parents, there would be contributed one-half, each contributing one-fourth. From the grandparents, there would be contributed one-quarter, each contributing one-sixteenth, and so on, the contribution diminishing with the remoteness of the ancestors, until the sum total of ancestral inheritance would equal one. By the second law, he attempted to establish the principle of the tendency to mediocrity; that is to say, that highly specialized traits in the parents would be less highly specialized in the offspring. He applied this law particularly to the quantitative

traits, as height in man. Thus "the stature of adult offspring must on the whole be more mediocre than the stature of their parents, that is to say, more near to the mean of the general population." Galten recognized that almost continuous changes were occurring in the morphologic and physiologic structure of man, and his investigations may have been of considerable value to the science. His findings are considered at the present time to be of doubtful importance.

Jennings, an eminent biologist, wrote in 1910: "Galten's laws of regression and ancestral inheritance are the product mainly of a lack of distinction between two absolutely diverse things, between non-inheritable fluctuations on the one hand and permanent genotypic differentiations on the other."

Weisman recognized the difference in variations due to environment and known as fluctuations, and those due to hereditary causes, a change in the germ plasm, and known as mutations, one of which is transmissible (mutations), while the other (fluctuations) is not.

DeVries emphasized the importance of this distinction. Conklin writes:

> All hereditary variations, whether due to new combinations of old characters or to the appearance of actually new characters, whether small and continuous, or large and discontinuous, have their causes in the organization of the germ-cells, just as do inherited resemblances. Heredity is not to be contrasted with variations nor are hereditary likeness and unlikeness due to conflicting principles: both are the result of germinal organization and both are phenomena of heredity.

The study of heredity as a causative factor in producing malocclusion of the teeth would not be complete unless one widened the scope to include a consideration of the theories of eminent men which are still debatable. However, the solution of the problem is more likely to be found in a comprehensive study and the intelligent application of the basic principles of the mechanism of heredity as enunciated in the work of Mendel. While the results of Mendel's experiments were presented in 1865, it was not until thirty-five or forty years later that it was given any serious consideration. His ideas have been greatly advanced and his methods of conducting experiments much improved on by modern biologists. Yet the basic principles have been conserved and seem destined to be the greatest factor in solving that mysterious phenomenon, the mechanism of heredity. Mendel's law deals solely with the germ-cells. In his experiments with garden peas, he selected plants of pure strain but with contrasting characters, for example, the tall-stemmed and dwarf varieties. When he crossed these varieties, the result was all tall-stemmed plants, the explanation being that the chromosomes in the germ-cells of the tall-stemmed carried the dominant, while the dwarfs carried the recessive characters. When these hybrids (the result of crossing plants of contrasting characters) were self-fertilized, they gave rise to a second filial generation of progeny some of which showed the dominant characters and some the recessive, the ratio being approximately 3:1; in other words, the result was three tall-stemmed to one dwarf. These experiments, often repeated, always produced approximately the same results. The explanation of this phenomenon is to be found in the peculiar distribution of the chromosomes in the germ-cells of the hybrids, each hybrid carrying in its germ-cells, both the dominant and recessive characters; but, by a certain mixture of the chromosomes, either by a dilution of the dominants or by a double dose of the recessives, the results produced were as

indicated above. Modern biologists have much enlarged on the methods and technic of Mendel and have applied his law in exhaustive experiments on animals; whereas, his experiments were confined to plants. The germ-cell theory of Mendel, of hereditary transmission, I have been informed by at least two authorities, has been universally accepted by scientific investigators. While there has been more or less variation in results, as might be expected, and the ratio of 75:25 has not always held true with regard to the expression of dominant characters versus recessive characters, there is an abundance of evidence to substantiate the germ-cell theory, and the number of characters in man which are now known to follow the Mendelian type of inheritance is surprisingly large.

Variation in man, whether inherited or acquired, always has been and is still one of the important problems of evolution. It has produced in man a great variety of types and characters. There is no doubt now that a developing organism may be greatly affected by the environment in which it lives. The same truth follows that organisms may show marked differences when developing in the same environment, owing to their having inherited different characters. The differences that may be observed in the human race are almost legion; which may be accounted for by the infinite number of variations, the minuteness and variety of which are now known to follow definite laws of inheritance. One must recognize the fact that both differences and similarity may be inherited. Professor Gates writes:

> The biological characters or differences observable in the human race and for the most part inherited include not merely the more striking racial divergencies, but also the innumerable structural and mental or temperamental differences that we see in the individuals of any population, however "pure" the race. Color of hair and eyes, height and size of various parts of the body (for there is some evidence that these may be independently inherited for different segments), conformation of the head and features, size and shape of eyes, ears, nose, mouth, hands and feet—there is good reason to believe that the element of inheritance enters largely into the perpetuation of a host of such differences as well as others more minute.

There is every reason to believe that some characters in every individual are produced by environmental stimulus, while others are determined by inheritance, although, in the development of the character, an interaction of organism and environment takes place in both cases. Whenever a new character does appear through a variation, or when a character of an unusual type manifests itself during development, which may be evident in the parent, the question immediately arises as to whether they are inherited. I am thinking of some of the cases of malocclusion that we are quite uncertain about. When one thinks of the power of heredity and its many accompanying complexities, it becomes a most difficult task to make an intelligent deduction in a given case; in fact, in any case. The phenomenon of the inheritance of physical characters in man is most intricate, and yet it is this question in which we have the greatest immediate interest. That harmonious physical characters are transmitted there can be no doubt; but it is quite uncertain whether disharmonies of physical characters are transmitted which are known to be of distinct detriment to the individual. If one should make but a casual observation or be possessed of only a superficial knowledge of the subject, he could not but wonder why there are not myriads of disharmonies or deformities in physical characters due to the admixtures of

races, great differences in stature of parents and the many physical deformities, if such things are inheritable. I have reference, of course, to the direct inheritance of structural deformities or disharmonies. We know that such things do occur and are emphasized by certain hereditary tendencies or influences such as diminished or perverted function, but the extent to which structural deformities are affected by hereditary influence or unfavorable environmental conditions has not as yet been determined. The eye, color and disproportion in stature between parents may be explained by alternative and blended inheritance. Galten writes in his book on natural inheritance: "Stature and eye color are not different as qualities, but are more contrasted in hereditary behavior than perhaps any other common qualities. Parents of different statures usually transmit a blended heritage to their children, but parents of different eye color usually transmit an alternative heritage." As a corollary, the explanation might be further clarified and better understood by the application of Mendel's law, wherein the results are dependent on a certain arrangement, distribution and division of the chromosomes. Dwarfism, giantism, color blindness, left-handedness, digital abnormalities, deaf mutism, malformations of the eye and many other physical and mental characteristics have been fairly well explained as regards heredity and its influence, by the investigations and scientific research of the biologist; but our problem, the problem of malocclusion of the teeth and deformity of the jaws, as concerns heredity and its influence, has been practically untouched. The field, while extremely fertile, is relatively a virgin one.

Dr. Drinkwater published in the year 1916 a report of a number of cases of modified brachydactylia (abnormal shortness of fingers and toes), which might be of interest, since it seems to show that what appears to be structural deformity may be inherited. He traced through four generations a case of abnormal segmentation of the index and middle fingers, the third finger being much longer than any of the others, owing to the great length of its proximal phalanx. Of thirty-six descendants of the abnormal members of the family, fifteen were affected. Another case of digital abnormality was handed down for more than 500 years and through fourteen generations.

I have purposely devoted most of the time allotted for this presentation to a discussion of some of the basic principles of heredity, for the reason that, in my belief, we as orthodontists cannot make much progress in the solution of our problems unless we have at least a fair comprehension or knowledge of the mechanism with which we are so much concerned. Those cases of malocclusion of the teeth which are produced by heredity, or are the result of hereditary influences, do not occur as a mere accident, circumstance or coincident, but are the results of well defined plans on the part of nature. Probably, you would have preferred to have me classify, in this discussion, all of those cases of malocclusion which are due to inheritance and all of those which are not. In the light of present knowledge, it cannot be done. That there are certain types of malocclusion inherited or rather that there are certain inherited tendencies or influences which will produce certain types of malocclusion, there seems no doubt.

I wish to report three cases which are more or less typical of the numerous cases with which the orthodontists are brought in contact.

REPORT OF CASES

CASE 1.—This case comes under the Angle Classification as of Class 2, Division 1. The history is as nearly authentic as would be expected when the parents themselves have not been observed. In the first generation, the mother presented all the characteristics peculiar to Class 2; namely, protrusion of the maxillary anterior teeth, a constricted arch, underdevelopment of the maxillae, shortness of the upper lip, mouth breathing, receding and underdeveloped mandible, hypertrophy of the lower lip, bilateral distal occlusion, a muscular unbalance and the characteristic facial expression. There were four children in the family, two of whom were affected, both sons. In the second generation, one married son had four children, one of whom, a daughter, presents a typical case of Class 2, Division 1, malocclusion. In the third generation, the daughter has four children, one girl and three boys. The two older children, a girl and boy, have escaped, while the two younger, both boys, present the same characteristics as the mother, not as yet so much exaggerated as the mother's it is true, but the children are only 8 and 5 years of age, respectively. According to the most reliable information obtainable, this particular type of abnormality has been present in at least four generations. I have seen only two. The cases are well defined, and there is no question about the ultimate results if orthodontic interference is not inaugurated.

CASE 2.—This case comes under the Angle Classification as of Class 3. Again, the history is as nearly authentic as can be expected. In the first generation, the father presented the characteristics of Class 3, a prognathous and overdeveloped mandible, mesial occlusion and the characteristic facial expression. There were three children, one of whom, a boy, developed a great physical resemblance to his father. The mandible is overdeveloped, the maxillae are underdeveloped and the lower arch is in mesial occlusion—a typical Class 3 case. In the second generation, this son has two children, a boy and a girl, both showing the same characteristics, although the mother is normal in respect to jaws and teeth and general physical development. The boy, who is the older, shows a much more exaggerated case than does the girl, his case being more extreme than the father's. Here, we find in three generations at least typical cases of Class 3 malocclusion of the teeth.

CASE 3.—This case comes under the classification of missing teeth. In the first generation, the father had two mandibular incisors missing. He had a family of four children, one daughter and three sons. Unfortunately, I have direct evidence of only one son, the youngest, who has one mandibular incisor missing. This son has a family of two children, a boy and a girl. The boy has two mandibular incisors missing and the girl has one missing. Thus over three generations at least, there are missing mandibular incisor teeth. As far as I could learn, there were no missing teeth on the mother's side of the family.

As I stated before, I do not believe that these are particularly unusual cases in the practice of the average orthodontist. To what extent these cases may have been influenced by heredity or by environment, I am decidedly unable to determine.

ESTHETICS IN RESTORATIVE PROCEDURES*

By W. D. VEHE, D. D. S., Minneapolis, Minn.

A PROPER appreciation for esthetics, together with a modern conception of health principles, must be on a parity if we are to exercise our full opportunity for service to our patients. Prevention, naturally, is the noblest ideal we can have in mind. Health is the goal toward which all of our efforts must be bent, but when disease has claimed its toll in the mouth, our conception of the restorative art in our reconstructional procedures should be as conclusive and lofty as is our appreciation for the health functions of nature and their maintenance.

Esthetics is defined as the theory or philosophy of taste, a science of the beautiful in nature and art. Esthetics in dentistry, then, has to do with the beauty and harmony of the human mouth. With such a conception of the term, it is obvious that the health of the oral tissues is the first essential of true and lasting beauty, and that this ideal may be expressed in the replacement of lost structures by a proper regard for their color, their form and position, and their function and health tendencies.

Man has always loved the beautiful in nature and has striven to imitate it in his art. This urge was likewise manifested in the repair and replacement of the teeth with the desire to conceal what was not real on the one hand, and to decorate the teeth in various and novel ways on the other. As civilization progressed, this desire to make the repair of these tissues less evident gained the ascendency, but these early efforts were more in the direction of color, at least form was manifested only in a very crude way. Accurate tooth form is a modern accomplishment which was not recognized until it was found that nature had a plan or purpose in the shaping of our teeth and in the placement of them in the arches, and if this was violated by us in the replacement of any lost structures, discomfort and lack of function resulted, followed many times by disease and the subsequent loss of these and adjoining members. This led to a closer observation of true tooth form and the relationship of the teeth to one another, and resulted in a better evaluation of these immensely important points in a closer realization of our ideal for beauty in the mouth. Perhaps the method for teaching dental anatomy to the student had something to do with the lack of appreciation of the subject by him. At least, every dental teacher must have observed that the student made little use of his training in the subject in applying it in his work where a practical application should be expected.

The modern conception of beauty in relation to the mouth is to conceal any artificial replacement. Porcelain is the most effective material with which our

*Read before the Chicago Odontographic Society, Feb. 20, 1928.

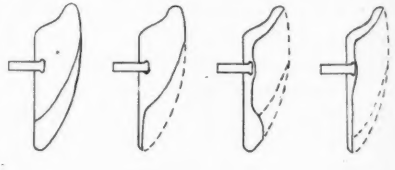
ideal can be realized, and it occupies such an important place among our restorative materials that our sensibilities would be shocked indeed if we were suddenly to be deprived of it.

In the restoration of portions of a tooth crown, the porcelain inlay is demanding more consideration as it is better understood and its weaknesses are overcome. In the repair of certain areas of a tooth crown, as, for instance, in the labial surfaces, and the buccal surfaces of the posterior teeth when esthetics demands its use, it is unequaled by any other material that is used today. In these areas, its permanence cannot be questioned; it meets the color requirement fully, and it is a greater preservative of tooth structure here because of its clean surface, preventing largely the formation of plaques and consequently recurring decay. This is also largely true for porcelain in the proximal surfaces of the anterior teeth, in fact, for the restoration of any area of a tooth crown where the surrounding physical conditions permit its use with the proper degree of safety. In the latter cases, the forces and area of occlusion and the bulk of porcelain obtainable indicate the probable permanence of the operation, and its use must be determined on this basis.

The highest embodiment of the artistic is possible with porcelain in the restoration of a tooth crown. The veneer crown lends itself completely to color in the minutest detail, and individual form is possible to the same degree; in fact, the accuracy of reproduction of any individual tooth that is undertaken with the veneer crown is only limited by the lack of ability of the operator. His understanding of the conditions to be met and his conception of the artistic can be fully expressed in this operation.

In reference to the inlay, the operator naturally cannot use it universally in restoring tooth structure because of the natural weakness of porcelain and, in consequence, he must use his judgment as to its probable service in any particular case. This is not true in the same way of the veneer crown, and so advantage may be taken more freely of these esthetic qualities which make this crown such a valuable contribution to our life-like restorative facilities.

It is in the replacement of structures other than individual teeth that the problem of esthetics has not come into its own. It is true that the use of facings and porcelain teeth as they are available to us has largely helped to place bridge and denture work in the exalted[3] position they occupy today, and it is not the intention of this paper to minimize this influence. It is my purpose to deal with the problem of esthetics in restorative work, and, in this survey, to include the shortcomings of the manufacturer's products in striving for this ideal. This is not done in a spirit of criticism, for the manufacturers never could fully meet our requirements in this respect. There is something more



Color distribution. Color is generally distributed in porcelain facings as is shown at (*A*). When the incisal color is found to be incorrect, it may be cut away and the right color and its distribution may be built in (*B*). The same may be done for the cervical color correction (*C*) or where a facing must be altered entirely (*D*).

to be desired as to both color and form of the porcelain teeth that are manufactured even today.

Our problem in restorative work is to render it inconspicuous and, as such, not only is the color of supreme importance, but the form likewise. In a survey of these requirements, it is evident that the incisal or occlusal portions of our porcelain facings or teeth as well as their cervical areas must be in harmony with the color demands of the mouth. This is only a part of our problem, for form plays an important rôle in producing a lifelike appearance. It is obvious, then, that there are three requisites that each facing or porcelain tooth must meet in order to serve our purpose correctly, and it is equally obvious that the happy combination of these three essentials is rarely to be found at the same time in the facings that they are available. This condition, while it is certainly unfortunate, makes it particularly difficult, except in rare instances, to obtain entirely pleasing results in supplying lost structures unless proper steps are taken to correct them. This same condition, which must be contended with in the porcelain crowns and the plate teeth, is plainly the reason why so many of our artificial substitutes both in bridgework and dentures are so often grossly in evidence. Bridgework in the anterior part of the mouth, for instance, is often easily detectable at ordinary conversational distances. Then also it is comparatively easy to point out patients who wear dentures. This is not true alone of poorly constructed work: carefully devised and placed structures often do not lend themselves to the esthetic requirements of the particular mouth. In bridgework, the appearance of the tissues around the abutment teeth and the pontics often discloses a bad condition fundamentally, and the color and form of the teeth, or should we say, form and color? in the restoration, are not in harmony with the requirements of the mouth. They lack in esthetic coordination in that there may not exist a single point of similarity but rather a contrast which attracts the attention of an observer. In denture work, there are many factors which must be observed to obtain the desired esthetic effect. Not only do color and form show quickly, but the correct placement also of the teeth is vital. Dentures otherwise excellently conforming to individual requirements can be detected more toward the angles of the mouth, especially from the distal half of the upper cuspid and the bicuspids, which are the final betrayers. In these cases, attention ceased perhaps when the cuspids were placed; at least, the work was not carried to a harmonious conclusion.

Color is the silent music of nature. It is given to us for our enjoyment and we feel its subtle influence through life. This color symphony, sometimes an inspiration and at other times depressing, ranks with music in beauty and charm. Its fullest enjoyment and appreciation must be cultivated as in music. Unfortunately, the study of color has been neglected in too many instances, particularly by men. Whether we recognize it or not, all of us are expressing ourselves in color in most every phase of our lives by our surroundings, dress, speech, etc., and no matter what the individual may think of this influence, or whether one cares what it may be, on closer analysis it will have to be admitted that one's color expression may be pleasing to others or even positively annoying, and their actions toward us must be influenced in some way thereby.

Fundamentally, color is entirely dependent on light, which is thought of as a radiant energy emanating from some luminous body. Sunlight is composed of ether waves that have a high frequency of between about twenty-three trillion and fifteen hundred trillion cycles. The human eye is altogether incapable of perceiving more than a small part of this entire scale of frequencies, for it cannot begin to detect the infra-red rays until they reach a frequency of about 375 trillion cycles and it ceases to recognize the ultraviolet rays after they reach a frequency of somewhere around a thousand trillion cycles. This was determined by different observers, notably Sir Isaac Newton, who, in 1672, analyzed a beam of sun light through the spectrum for the first time. In 1800, Herschel found that the spectrum continued beyond the visible, red end with the aid of a thermometer, and, in 1801, Ritter proved the existence of the ultraviolet rays beyond the other or violet end of the spectrum by its action on silver chlorid salts. These observers, together with others, found that sunlight was perhaps the most perfect white light and that its whiteness was dependent on a definite distribution of the rays of different frequencies. This, in turn, proved that when these rays were not so distributed, white light would not result but that the light would show the influence of the predominating ray or rays. This point is of importance to us and will be taken up later.

In these observations, it was also possible to measure the frequency of the spectral colors, which were found to be mathematically definite. The primary colors are the principal colors found in a spectrum, and Newton's seven were red, orange, yellow, green, blue, indigo and violet. In color synthesis or mixture, it was found that there really are three primary colors, and the Newton-Brewster theory, that red, blue and yellow will produce any and all the other colors, seems to be the accepted one at this time. When these three colors are mixed together in the form of pigments, black or gray may be produced; while if beams of lights of these same colors are thrown together in proper proportions, a white light will result. A color that will produce gray when mixed with another color is spoken of as being its complementary color, and in such a color reaction, one or the other of these colors is always a mixture of two of the primary colors to begin with, or each of the colors may have a mixture of a color that is common to both.

The visibility of a nonluminous object is entirely from the amount and kind of light that is not absorbed but is either transmitted, reflected, or refracted to us. An object that reflects light equally is thought of as white, while objects that do not have this property show colors. There is no known object which either absorbs or reflects all of the light that reaches it, and, in this connection, it must be apparent that the character of this reflection must be in direct ratio to the amount and kind of light which reaches it. It is difficult to explain the complexities of the action of nonluminous bodies on light. Observation shows one that there are hardly two alike. A surface that is polished has entirely different characteristics from one that is roughened, and the degree of roughness likewise makes a difference. A surface may be plane or wavy, and the opacity or transparency of an object each has its own particular influence. The variety of effects that may be observed in nature are almost limitless, and each object has

its particular influence on the light which reaches it. This is another point of interest to us for a later consideration.

The psychology of color or the reaction of the human eye to color is always most interesting. Sensations of color are perhaps dependent on the retinal structures known as the cones, and how the eye perceives color is not definitely known although there are several theories which propose to explain it. The Young-Helmholtz theory assumes that there are three sets of nerves corresponding to red, green and violet, and that any color stimulation reacts on these nerves in different degrees. This hypothesis implies that the different hues of the visible spectrum with their tints and shades are recognized by us on the theory of color mixture. The Herring theory indicates that there are in the retina three substances affected by light, one by green and red, another by blue and yellow and the third and most plentiful by black and white.

White, gray and black are not spoken of as colors but as forming the scale of brightnesses. The action of the retina seems to be to neutralize whatever color is viewed by the addition of its complement. This is plainly evident in many ways. When viewing two colors that are placed side by side and which are complementary, it will be observed that each is more brilliant along the line of contact. This example in itself does not conclusively show the truth of the foregoing statement, but a prolonged inspection will be convincing. This is more plainly shown when viewing a single color and then focusing the eye on a neutral field which will show a successive contrast in the form of an afterimage that always is the complement of the color viewed. Again, in looking at this original color, if instead of focusing the eye on some neutral field, it is focused on a colored field, we then observe a mixed contrast in that this afterimage is superimposed on the colored field and a mixture of the two colors results. These after-images are brought about by fatigue of the retina in viewing a color, and they become strengthened as the color inspection is prolonged to the point where this reaction results in the graying of the color that we look at. The explanation for this is that when a color is mixed with its complement, a gray or black always is formed.

From this short discussion of the physics and psychology of color, one must observe that color is an invariable science fundamentally in that its reactions and manifestations are definite under like conditions. It must be evident at once that our source of light is very important; for not only does the intensity or the lack of it particularly make it harder for us to see colors correctly, but also the kind of light, whether it is white light or one that has a predominance of some color rays, likewise lends itself to a correct color determination. For instance, it is observed that the difference in the yellow and orange hues cannot be so readily differentiated in direct sunlight. As these hues are the fundamental colors in the human teeth, it follows that direct sunlight would not be the best light to view them in. Again, reflections of colors in a room or from some outside source, as from buildings, roofs, walls or even green trees, may cause one much trouble because of their contamination of the light source.

The effect that the object, in our case the teeth and surrounding structures, has on the light rays is likewise important to us. This is particularly so

from the standpoint of its physical makeup, i.e., its quality of color reflection or surface texture, whether it has a polished surface or a rough surface, or whether it is plane or wavy, and the character of these inequalities, and also its opacity, or, shall we say, translucency. There are other points that must be observed, but these are the more important.

Now as regards what we actually perceive, it must be borne in mind that about 5 per cent of the population is to some degree color blind. Those who are thus affected cannot expect to get the usual reaction from colors. The normal eye is capable of all the psychologic reactions that have already been mentioned, and in determining color in the mouth, these reactions must be guarded against. It is probably true that the average operator observes the cervical color of a tooth first and the incisal or occlusal color lastly. The cervical color is some hue of orange, and, as such, it is possible that it may be influenced by the decided redness of the lips or gum tissues, particularly if this color is a tint bordering on whiteness. Since the tendency of the retina is to neutralize color by the addition of its complement, it is reasonable to expect the complementary color of the lips or tissues, which is green, to modify or even change the cervical color so that it may be perceived as being lighter or even as having a bit of green in it. This is especially true if we have had to spend much time in this determination, as the retina is easily fatigued when viewing colors. The incisal or occlusal portion is likewise apt to be influenced by the complement red or even the cervical, orange color.

It is my experience that this influence is only to be guarded against in light colored teeth, particularly if the surrounding tissues are intensely red, and that, in the darker colored teeth, or if these tissues are not highly colored, this difficulty is not so likely to be experienced.

Any determination of the first requirement of an esthetic restoration, that of color, had best be made with these points clearly in mind. Our first concern should be the light condition in that both the intensity and the kind of light has a bearing on what we will see, and so perhaps we cannot hope for a more favorable light source than a diffused natural light of average intensity which, at the same time, is not contaminated by any reflections from nearby intense colors. Such a light condition should enable one to see the colors in the teeth correctly for the purpose of determining the colors for our restorations whatever they may have to be. The teeth naturally should be clean and free from stain and discoloration, and they should not have been dried just previously. The cervical color of the tooth should be carefully observed, and we must be sure that we see it accurately. The color is then matched as accurately in our porcelain colors or on a tooth color-guide. The same is done, and in like manner, for the incisal or occlusal color. These respective colors may best be recorded on a suitable card bearing the patient's name, and the date, together with a diagram of the labial or buccal outline of the tooth in question.[1] The extent of one color with the other can likewise be shown accurately. Any other data, such as staining directions, measurements or any other information that will be helpful in building the work can be included.

A word about our color guides becomes necessary at this time. These

1. This color determination is fully described and illustrated in: Vehe, W. D.: Porcelain Technic as It Relates to the Inlay, J.A.D.A., 14: 1469 (Aug.) 1927.

must be accurate if we are to be sure of our color interpretations. The porcelain color guide should either be checked for accuracy or made up from the porcelain in the laboratory. The tooth color guide cannot be checked in this way, and so the facing or porcelain tooth should be selected with it directly and then checked in the mouth preferably.

With such a color determination as a guide in the laboratory, it remains for us to develop our work from the colors in the proportions as depicted on this chart. In the inlay and the veneer crown, this part of the technic should not be troublesome. Any difficulty one does encounter that may spoil the final color of such a piece is usually due to other conditions provided the color chart has been followed in detail. Our porcelain facings and teeth present an entirely different problem. As has been previously discussed, we have a series of them manufactured in a combination of cervical to incisal or occlusal colors in a variety of sizes and shapes. These are made up by a number of manufacturers, and all that is necessary is to select one among them that accurately meets every requirement for our case. It is not necessary to point out how easily this may be done and yet we have all tried it and failed in the majority of cases, and so since this is the condition one does encounter, and also since our sense of the beautiful will not permit us to compromise in the patient's disfavor, even though it had to be done in the past, it is necessary that we make what changes we must to better meet our conditions ourselves. It is possible, of course, and in some cases even desirable, to build up the entire facing of a tooth, but, for the average operator, the altering of a pin facing or porcelain tooth is unquestionably the simpler method, and his results should be just as good. His purpose should be to make his facing or tooth selection match the cervical portion of the teeth if possible. It is taken for granted now that no substitute has been found which meets the color and form requirements of the case satisfactorily. If the cervical color cannot be matched, one can attempt to select with the incisal or occlusal color in mind. Usually, this may be done for either portion of a tooth, but there are times when it will be necessary virtually to rebuild a facing or tooth, as shown in the accompanying illustration.

After such a selection has been made, the porcelain substitute should be checked in the mouth, after which the changes that are necessary in it may be made by first cutting away the color or colors that are not in harmony and then rebuilding it to conform in both color and form.

The problem of color in our porcelain restorations does not end here, for an otherwise perfect piece of work may be ruined by the color of the cement in the final placement of it. It has been my contention for a number of years that a gray oxyphosphate cement should have no place in a dentist's office. Time has not made it necessary to alter this opinion, but has only strengthened the conviction that, for best color results, a cement should be as nearly as possible the color of the work under which it is placed.

The second factor, that of correct tooth form, must also be a vital consideration, to supplement proper color, for an entirely pleasing result. This is as important as color because a restoration that is of the right color but of a poor simulation in form is certainly inharmonious, no matter how accurately the color interpretation may be. On the

other hand, one that accurately interprets the individual form, allows a certain limited latitude in the color and still will appear entirely right. It should be our purpose to study the individual requirements in this respect, either in the mouth or on entirely accurate casts, or from both.

The position that artificial substitutes should assume must not be overlooked. A correctly colored tooth of the proper form, if it is gracefully placed to harmonize, will enhance its naturalness. So it is obvious that to our restorations in harmony with the requirements of a mouth, several factors must be incorporated in the work, and it is not possible to speak of any one of these as being all important. It is only by the proper inclusion of these points that our restorations can be of the highest order. The man well versed in health principles who disregards beauty and harmony when he is called on to repair or replace lost structures is as one-sided as he who overlooks the health of the mouth and proper function in his restorations in his enthusiasm for esthetics, and neither man can render his patient the highest service with such an attitude of mind. It is well enough to make a detailed study of our problem in esthetics, but it is quite another matter to come up to this ideal in our restorations unless we first carefully observe the important details and then incorporate our findings on the basis of a sound and an entirely reasonable presumption.

We do not observe accurately nor sufficiently in detail. Consequently we lack definite knowledge. Our observation includes only what we expect to or are accustomed to see, and unless we make a conscious effort to look for the details, much that is all important gets by us.

"Trifles make perfection but perfection is no trifle"; and so an exact understanding of the fundamentals of any subject is essential to its accurate application.

823 Nicollet Avenue.

DISCUSSION

Hart J. Goslee, Chicago, Ill.: I do not think the profession has ever had so complete a paper as has been presented to us tonight by Dr. Vehe. His introductory paragraph calling attention to the fact that esthetics plays such an important part in our work will be valuable in any body of dentists, whether they are prosthetists or not. Such a thorough study of the philosophy and physics of color as here presented has never, in my opinion, been given before a dental audience. Dr. Vehe estimates that probably 5 per cent of the people of the country are color blind. If you will observe the restorative work in the mouths of the average patient, you will conclude that 95 per cent of the dentists are color blind instead of 5 per cent, and papers such as this bring to our mind how far short most of us fall in observing color schemes in our restorative dentistry. Harmony is the basis of all of it, but we cannot reproduce nature and produce harmony, which is so essential in our work, until we know something about color.

Charles E. Meerhoff, Chicago, Ill.: The need for esthetics must be obvious to all of us. If one did not advocate the use of porcelain as a veneer crown or the inlay for any other than prophylactic reasons that would be sufficient, and if I did not say anything more in favor of porcelain, if I did not advocate the use of porcelain, I would certainly say something against so-called synthetic porcelain. There is no question that the use of porcelain from this day on will be greater. I have advocated its use for several years, and I have thought for the past few years that men were getting back to the old school, the old idea, not from the standpoint of devitalization of pulps by these synthetics or porcelains, but because we got no results, because they were not fillings. I hark back to the first veneer crown that I remember seeing and I have watched the evolution of these and the art connected with it for all these years, and while you know the results today are so vastly greater and

more improved over those of that day, there is much to be wished for even today. A few moments ago, I asked Dr. Vehe what proportion of the so-called veneer crowns he thought were made at laboratories. I made the estimate of 75 per cent. He thought that it was more. Within the year, I heard Dr. LeGro, of Detroit, remark that he admonished his hearers who were sending their work to the laboratories to practice a greater degree of precision. There can be no work, as I see it in dentistry, that calls for such fine precision as this work. Today, any of us who wish to, send this work out of our offices if we do not feel confident to do it. No laboratory man can do what you cannot do for him. He cannot make anything for you, the basic work of which you do not do for yourself. Dr. LeGro said, "If you want to send this work to the laboratory, do everything except the fusion of the porcelain. The very fact that you do not do it probably presupposes you do not have the baking facilities or do not want to take the time. If you want to send, make your models, give your laboratory men instructions so they can deliver the stuff and you will not have any failures." The porcelain inlay is bound to succeed. Dr. Vehe spoke of the use of restorations, meaning the inlay, particularly in posterior cavities. There can be no doubt that for prophylactic reasons it excels.

Stanley D. Tylman, Chicago, Ill.: There is no such thing as being an inspired son or anything else when it comes to porcelain work. Any one of us can do it. In the days of ancient Greece, two painters were engaged in friendly rivalry, and although they themselves never compared their relative qualities, work, etc., their friends did, to the extent that finally the two were brought together to decide which was the greater, and as there was no other way to come to a decision each decided to paint a picture by which he was to be judged. At the day appointed, they met in the public square, and the crowd, with the senate and the other dignitaries, came to one end of the square. The two artists approached and finally one said to the other, "I am ready," and drew back the curtains. His picture of wheat, berries and grapes, was so natural that the birds flew down and picked at the canvas. The population applauded, and the second artist bowed his acknowledgment of the wonderful masterpiece. Then the first artist said to the other, "Withdraw your curtains that I may see your picture." The second artist replied, "The curtains are the picture." He was proclaimed the greater artist. The point of the story is that we all strive not to proclaim art by our work but rather to hide the result. I believe that is your message, Dr. Vehe, and in porcelain work more so than in any other field is this true. Working with porcelain is very fascinating. In fact, we have found that men want to take this work before they have two or three periods, I mean postgraduate students become so enthusiastic that, after they have had six or ten hours, they are anxious to take porcelain work. The possibilities which are attainable with porcelain really merit the intense interest which is sweeping the country at the present time. Porcelain is now not considered a "high-hat" course, if I may so express myself, but as an essential in every curriculum, and it is being taught side by side with gold inlay, bridge and denture construction. I do not believe the profession is converted to the idea of the porcelain inlay, owing to the difficulties of the margin, etc. As regards the gingival inlay, Dr. Vehe mentions the gingival inlay which lies entirely within the area of the gingival color. In studying teeth, we have noticed that the different color effects, and that is what we have, color effects rather than colors, must be produced by the different indices of light refractions as they strike the enamel. If our dentin is practically the same color, that is, some complement of orange or yellow, the enamel must to a great extent influence all the other modifications of that color. Is it not possible that the modifications of color depend on whether the enamel rods lie at right angles to the surface area or whether they are gnarled or sigmoid shape? If that is so, in the construction of a gingival inlay, where the color is apparently a solid orange, could we get a more synchronizing effect if we overlaid the gingival orange color with a small amount of the incisal color? We sometimes do this, and I wonder whether Dr. Vehe has had that experience.

Dr. Vehe: I am glad that Dr. Meerhoff called attention to the carefulness of detail that is necessary before the operator sends his work to the laboratory. Just why men should have a feeling that they can send almost anything in the form of an impres-

sion or what looks like an impression and the color requirements, and then expect to get a good result, I cannot understand. By constantly calling attention to this, we should advance the standard of dentistry to the point where the laboratories would take a place that they do not now occupy. Dr. Tylman spoke of the cervical inlay. When I go into the porcelain inlay, I am a little more careful than I am in the crown, and when I decide on the foundation or cervical color and then decide whether or not to use an incisal or enamel color, perhaps I use the incisal or enamel color over the inlay where I would not in the crown, but it is a question of working that out according to the effect you want. The apparent color of the object is not the color of that object, but the effect of the object absorbing the light rays and throwing them back, and the ones we perceive are the ones that give us the impression of the object being that particular color.

Dr. Idler: Would you mind telling us the kind of cement you use in setting these inlays and in porcelain jacket crowns?

Dr. Vehe (closing): I like to see a very finely ground good quality cement used. In my own particular practice I use yellow white cement for nearly all my work. I use the white cement to dilute the color of this yellow cement. A dentist should have no place in his office for a gray cement. I felt that I might be harsh and so bought a bottle of gray cement, and every time I used it, it was to my chagrin. Therefore, in my porcelain work I have come to use special yellow white cement, for it gives a better color effect than any other I have ever used.

VARIATIONS IN STRUCTURE OF HUMAN ENAMEL AND DENTIN*

By LAWRENCE E. VAN KIRK, A.B., D.D.S., Pittsburgh, Pa.

THE original purpose of this investigation was to make a study of the variations that are found in the hard structures of human teeth. The examination of any great number of sections of enamel, dentin or cementum reveals many variations in their structural elements. Some of these occur very rarely, while others are found quite regularly. As the investigation continued, some of these variations were seen so often that they could scarcely be considered rare or even pathologic, but must certainly be regarded as representing a normal element of the tissue. In order to determine accurately the frequency of the occurrence, a series of 450 sections of various teeth were studied. In this preliminary report, the occurrence of the following was determined: (1) enamel spindles; (2) so-called granular rods; and (3) secondary calcification in the pulp chamber. The arrangement of enamel, dentin and cementum at the gingival line was also studied.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology, and Chemistry (Research) at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

MATERIAL EXAMINED AND METHOD OF EXAMINATION

The material examined consisted of ground sections of human teeth from the collection of the histology department of the University of Pittsburgh School of Dentistry. The sections were ground from extracted teeth selected in the school clinic and many others sent to the school by graduates and friends.

They represent the teeth of persons of middle age or beyond; which probably accounts for the high incidence of secondary deposits in the pulp chamber. Practically all of these sections were made from noncarious teeth.

The enamel spindles have been the subject of much discussion, and the literature on the subject presents various explanations of their origin and possible function. As this investigation determined only the frequency of the occurrence of these structures, no comment will be made on the foregoing theories.

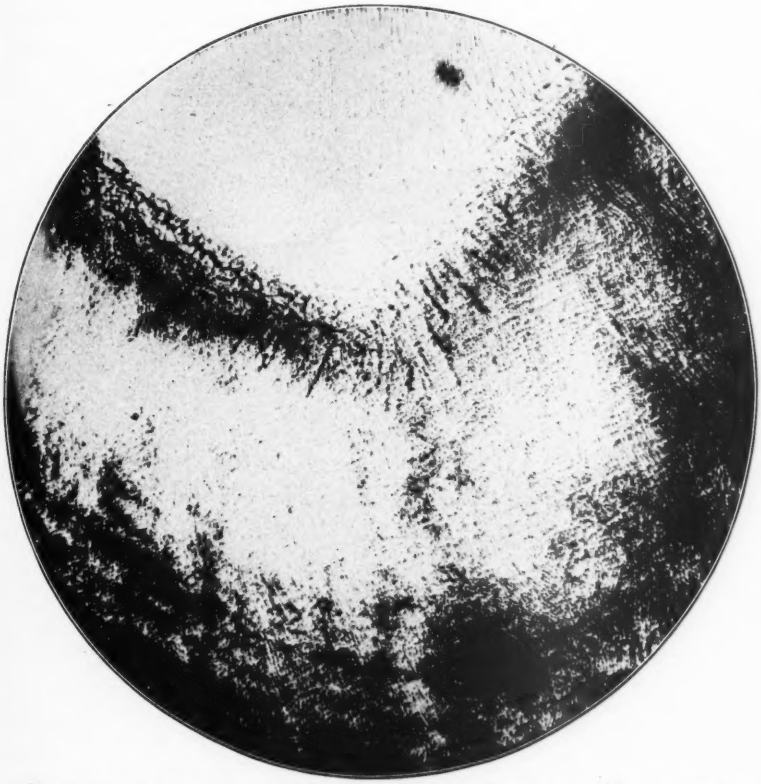


Fig. 1.—Section of an upper bicuspid, showing the spindles as seen at the cusp tip. (Low power magnification.)

The sections were numbered and fifty each of the following teeth were examined: superior central incisors, lateral incisors, cuspids, bicuspids and molars; inferior incisors, cuspids, bicuspids and molars.

Figure 1 is a section of an upper bicuspid showing the spindles as seen at the cusp tip. Figure 2 is a section of the same tooth, showing the spindles as they

appear along the side of the crown. Their direction here is always toward the gingival. Figures 3 and 4 are similar sections with greater magnification.

The granular rods are mentioned by both Mummery[1] and Hopewell-Smith.[2] in the calcification of the interprismatic substance. Whatever theory may explain their presence, their occurrence is so nearly universal that it seems impossible that so little attention has been given them in the past.

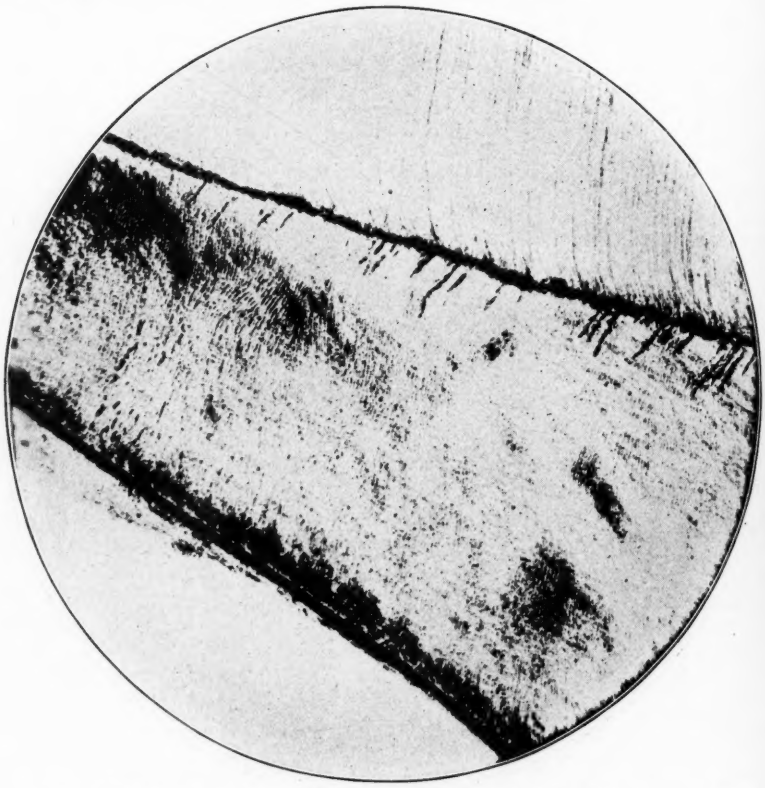


Fig. 2.—Section of an upper bicuspid showing the spindles as they appear along the side of the crown. Their direction here is always toward the gingiva. (Low power magnification.)

Mummery considers them imperfections

Figure 5 is a section showing these structures as they appear with low magnification. The dark areas in the enamel along its junction with the dentin are these so-called granular rods. Figure 6 is a higher magnification of these areas,

1. Mummery, J. H.: Microscopic Anatomy of Human Teeth, p. 83.
2. Hopewell-Smith, Arthur: Normal and Pathologic Histology of the Mouth, pp. 46-47.

showing plainly the granulated appearance, which prompted Hopewell-Smith to call them granular rods.

Figure 7 is another section of these structures. Figure 8 is a section in which there is an extra large overlap

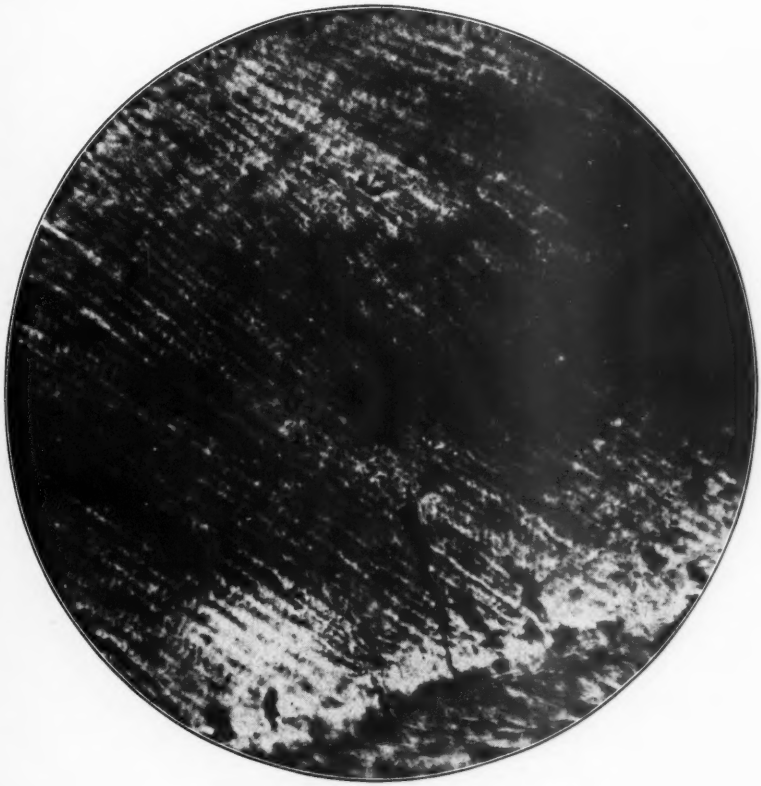


Fig. 3.—Enamel spindles. (High power magnification.)

of cementum at the neck of the tooth, a relation of cementum and enamel most frequently seen.

The relation of enamel, dentin and cementum in the gingival region has been studied by many investigators in the past, with varying results. In 1899, Jules Choquet[3] observed these tissues in twenty-nine teeth. His conclusions were that the enamel meets the cementum in the majority of teeth; which is not borne out by this investigation. In the investigation covering the observation of twenty-nine teeth, the results are probably in error. In 1917, an investigation by Thorsen[4] of a large number of sec-

3. Choquet, J.: L'Odontologie, February, 1899.

4. Thorsen: Den Norske Tandlaege Tidende, 1917. Footnote 2, p. 20.

tions gave results that are much nearer the findings of this present investigation. These will be mentioned later.

THE FINDINGS

As might be expected, the spindles were found in a high percentage of sections. In the central and lateral incisors and cuspids, they are concentrated near the cusp tip. If this tip was worn off or missing, no spindles were seen. This accounts for the large number in which no spindles were found; for in practically every case where no spindles were found, the tip was missing. In the bicuspids and molars, these spindles extend all along the enamel junction, far up toward the gingival margin. In these sections of bicuspids and molars, even though the cusp tip was missing, many spindles could be found along the dento-enamel junction toward the gingival margin.

Fig. 4.—Group of enamel spindles. (High power magnification.)

The granular rods or defective areas were found in every slide save one, that from a lower bicuspid, and it was so

very thin that it was impossible to locate any structures of this type. The universal occurrence of this variation, if it could be called a variation, demands some explanation of this phenomenon. Whether it can have some connection with vital function is as yet undetermined. Although it is possibly pathologic, it is a very frequent manifestation.

The age of the individuals from whom these teeth were removed probably explains the high percentage of secondary calcification in the pulp chamber. A rather interesting finding was that, in the bicuspids and molars, the deposits were met less frequently than in the anterior teeth. This is to be expected when we consider that, as the individual grows older and the bite gradually closes, the anterior teeth suffer more from attrition.

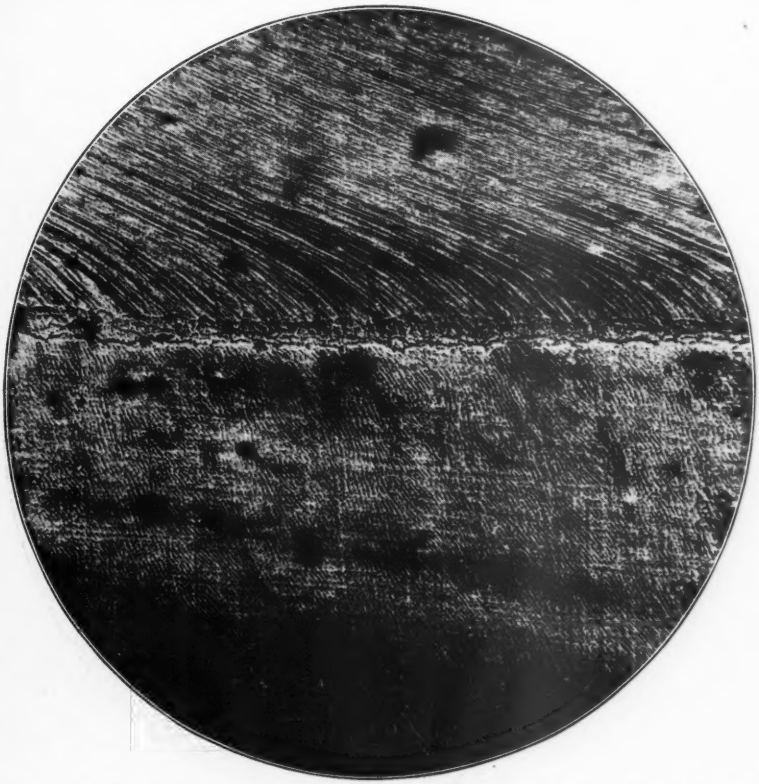


Fig. 5.—Photomicrograph of the dento-enamel junction showing the granular rods in the enamel. They are seen close to the junction as dark clouds in the enamel. (Low power magnification.)

In the examination of the gingival tissues, 322 specimens out of a possible 765 were so damaged or broken as to

be useless in such an investigation. This leaves 443 in which the findings were as follows: (1) The cementum overlapped the enamel in 297, or 67 per cent. (2) The cementum and enamel met in 99, or 22.35 per cent. (3) The enamel overlapped the cementum in 7, or 1.58 per cent. (4) The dentin was exposed in 40, or 9 per cent.

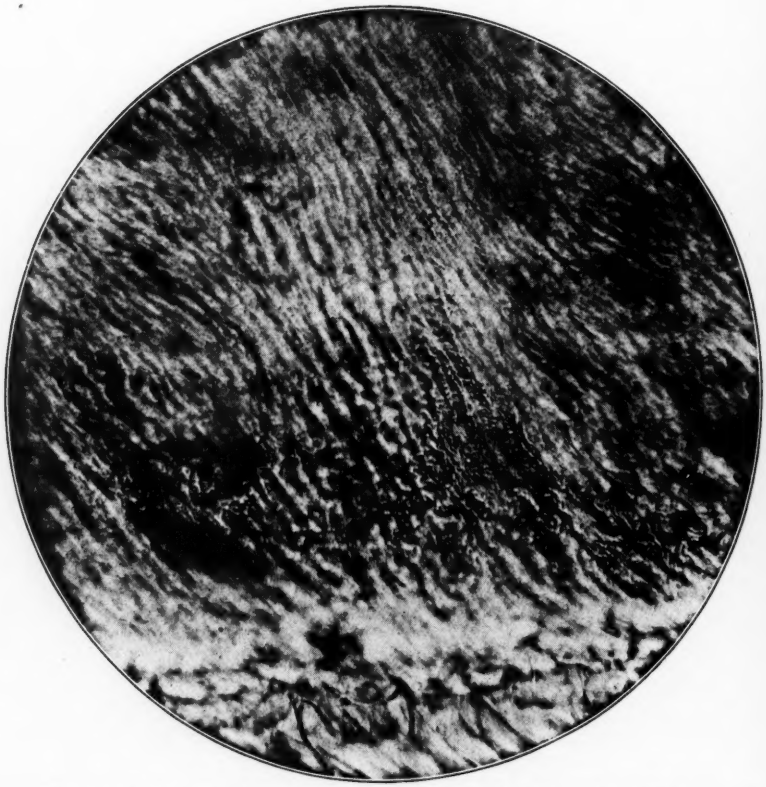


Fig. 6.—Section showing the structure of the granular rods. (High power magnification.)

STUDY OF RESULTS

Upper Central Incisors.—In twenty-six sections in which spindles were not seen, practically all had no tip of dentin or enamel where these structures are found in these teeth.

Granular Rods.—These were present in all.

Secondary Deposits.—In forty sections, secondary deposits were found; which is a higher percentage than in any other group (80%). This is probably due to the fact that apparently sound anterior teeth are not lost until

late in life, after they are badly abraded.

Gingival Tissue.—In thirty, or less than 60 per cent, the cementum overlapped the enamel; which is less than the average of the whole group (67%). In ten, or less than 20 per cent, the cementum and enamel meet. This is also slightly below the general average (22%). In one, the enamel overlapped the cementum. In fourteen sections, or 25 per cent, the tissues failed to meet and the dentin was exposed. This is higher than the general average (9%).

Upper Lateral Incisors.—In sixteen, spindles were not found because the cusp tip was missing.

Granular Rods.—These were present in all.

Secondary Deposits.—In thirty-two out of fifty, definite secondary deposits were found.

Fig. 7.—Granular rods.

Gingival Tissue. — The cementum overlaps in nineteen, or 35 per cent; which is much lower than the general average (67%).

The tissues met in twenty-seven sections, or 50 per cent; which is more than double the general average (22%).

As usual, the enamel very rarely overlaps. In two sections in this group, overlapping occurred. In six sections, the dentin was found exposed; which is just about the average (9%).

Gingival Tissues. — The cementum overlapped the enamel in the cuspids in 67 per cent, the average in the entire group. The tissues met in 24 per cent; which compares favorably with the general average (22%). In this respect, the cuspid resembles the central incisor; but the dentin was exposed in only seven sections; which is more like the condition found in lateral incisors.

Fig. 8.—Section showing an unusually large overlap of cementum in an upper central incisor. The enamel is covered for some distance by the cementum.

Upper Cuspids.—The results as to the presence of spindles in cuspids and laterals were almost identical. Defective rods were found in every section. The occurrence of secondary deposits was similar to that in the central and lateral incisors.

Upper Bicuspids. — The cementum overlapped in twenty-five; a percentage

SUMMARY OF FINDINGS

	Spindles		Granular Rods		Secondary Dentine			Gingival Tissues					
	Present	Absent	Present	Absent	Present	Absent	Undetermined	Junctions Examined	Cementum Overlaps Enamel	Cementum Meets Enamel	Enamel Overlaps Cementum	Dentin Exposed	Undetermined
Superior Central Incisors	24	26	50	0	40	7	3	100	30	10	1	14	45
Superior Lateral Incisors	34	16	50	0	32	7	11	100	19	27	2	6	46
Superior Cuspids	35	15	50	0	36	2	12	100	36	13	0	7	44
Superior Bicuspids	50	0	50	0	19	23	8	50	25	6	0	0	9
Superior Molars	49	1	50	0	16	30	4	51	31	6	0	1	13
Inferior Incisors	38	12	50	0	32	6	12	82	18	12	1	10	41
Inferior Cuspids	39	11	50	0	31	15	4	82	40	5	2	1	34
Inferior Bicuspids	49	1	49	1	26	19	5	100	43	8	1	1	47
Inferior Molars	50	0	50	0	27	23	0	100	55	12	0	0	33
Totals All Teeth	368	82	449	1	259	132	59	765 443	297	99	7	40	322
									67%	22.4%	1.58%	9%	

in this group of 61, the general average being 67 per cent. They met in six sections, 15 per cent, while the general average is 22 per cent. In no section was the enamel overlapping the cementum or was the dentin exposed. The latter condition is seldom found in bicuspids and molars.

Upper Molars.—Spindles were found in practically all the upper molars. Grandular rods were present in every section. Secondary deposits were found

in sixteen out of a possible forty-six of a percentage of 35, which is just about one-half the general average. As in the bicuspids, secondary deposits in the molars are less frequent than in the anterior teeth.

Gingival Tissues. — The cementum overlapped in 31, or 60 per cent, slightly less than the average for all teeth examined. The tissues met in six, or about 12 per cent, the general average being 22 per cent. The enamel did not once overlap the cementum, but the dentin was exposed in one section.

The sections of inferior teeth show the same general characteristics as the corresponding upper teeth. The lower incisors and cuspids, like the upper anterior teeth, show spindles at the top of the crown and very few in any other region. If the tip is missing, spindles are not seen. The secondary deposits were frequently seen in the lower anterior teeth, just as they were in the upper anterior.

The tissues at the gingival of the lower incisor show one peculiar characteristic: Twenty-five per cent of these sections have a space of dentin exposed. The general average is only 9 per cent. The upper central incisors had the dentin exposed in 45 per cent, greatly exceeding the average of 9 per cent.

The lower bicuspids and molars closely resemble the upper posterior teeth in many ways in the results. The secondary deposits are less frequent than in the lower anteriors.

The gingival tissues in the lower posterior teeth show a high percentage of cementum overlapping the enamel. In the bicuspids, the percentage of cementum overlapping was 81; in the molars, 82. This is the greatest increase over the average of 67 per cent that was found in any one group.

CONCLUSIONS

1. The enamel spindles are quite generally distributed in the bicuspids and molars. In the anterior teeth, they are usually concentrated around the incisal edge, and are not so numerous as in the posterior teeth.

2. The so-called granular rods are almost universally found. In only one of 450 sections were they not seen. This was a particularly thin section; which may account for the failure to locate them.

3. Secondary deposits in the pulp chamber were very common, owing, perhaps, to the fact that the individuals from whom these teeth were removed were advanced in years.

4. In two-thirds of the teeth, the cementum overlapped the enamel at the junction of the tissue with the necks of the teeth. This is very close to Mummery's 62.5 per cent and Thorson's 60 to 65 per cent. The cementum and enamel met in 22 per cent; which is lower than Thorson's 30 per cent, but greater than Mummery's 12.5 per cent. The enamel overlapped the cementum in only 1.5 per cent; which is greater than Thorson's result of 0.5 per cent, but less than Mummery's 12.5 per cent in teeth of aged persons.

The cementum and enamel failed to meet, leaving the dentin exposed, in 9 per cent, which is close to Thorson's estimate of from 5 to 10 per cent and not far from Mummery's 12.5 per cent.

While the examination of 450 sections may throw some new light on the frequency of the occurrence and the relation of these structures, it is not sufficient evidence upon which to base any definite conclusions. Many more sections will be carefully examined, and as this investigation continues, perhaps more definite or certainly more accurate results can be obtained.

SWAGED DENTURE BASES*

By W. J. PRYOR, D.D.S., Cleveland, Ohio

UNTIL Taggart gave to the profession the casting process, swaged denture bases were used, in the better class of work, for both partial and full dentures. The swaged base had well earned its place of favor, because it occupied a minimum amount of space in the mouth, was easy to keep clean, out-ranked other materials used in thermal conductivity and maintained a healthy condition in the tissues it covered.

Prosthetic men, alert to the advantages of Taggart's wonderful discovery, were soon employing the casting method in full and partial denture construction, as well as in crown, bridge and inlay work.

After it has been in use for more than twenty years, we find the casting process firmly and permanently established in all the classes of work mentioned above, with the exception of full, and some cases of partial, denture construction.

Cast full dentures have lost somewhat in favor because of the difficulty in producing a base of the uniform thickness and strength that can be obtained with a swaged base.

An occasional faulty casting, and the necessity of swaging the casting to obtain a perfect fit, also detract from any advantage the casting process may have shown over swaging.

For the same reasons, swaging is superior in those upper partial cases in which few teeth remain and the denture is supported entirely or mainly by the soft tissues. In these cases, we cover a large area with the base in order to secure a firmer foundation on which to build our case; and no base is so thin and smooth as a good swaging. The patient soon becomes unaware of its presence in the mouth.

During the past few years, improvements in the swaging technic, as well as in the materials employed, have simplified the operation and, at the same time, permitted the dentist to produce a more accurately fitting base, superior in physical characteristics to those used in the past.

From freshman college days onward, the problem of producing an accurate metal die to be used in swaging was feared and fumbled by the average man. Improved gypsum products, under the trade name of "artificial stone," have made the metal die unnecessary. Improved swagers have ruled out the counter die and sledge hammer. Improved base-plate alloys have given us a better base.

A good artificial stone will withstand the pressure necessary to shape a metal base, but it is essential that three rules

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 24, 1927.

be observed if consistent success is to be our goal. 1. Enough of the stone must be gradually added to the water to give us a mix of the consistency of putty. The mix should be spatulated thoroughly as the powder is added, finished up by kneading in the hands, and then vibrated to place in the impression. 2. The cast must set from twelve to twenty-four hours to harden before swaging is attempted. 3. The cast must be thoroughly supported underneath and around the sides in the swaging ring.

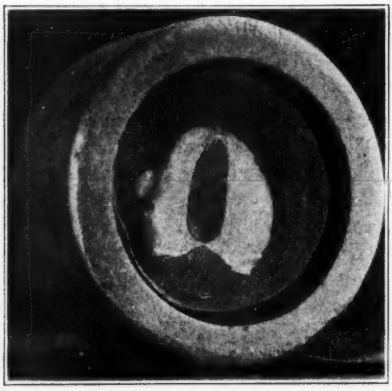


Fig. 1.—Cast imbedded in modeling compound.

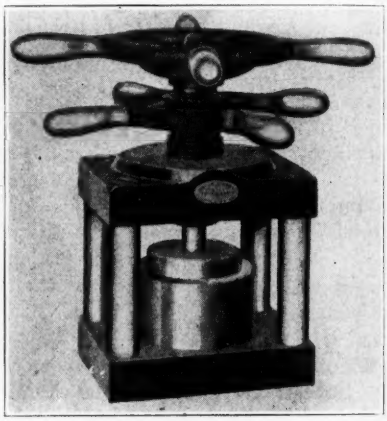


Fig. 2.—Swaging press.

This support can be readily obtained by seating the cast in the ring in modeling compound which has been softened in hot water, and condensing the compound around the stone with screw pressure in the swager. I know of no other method which insures us against broken casts. We know that we have applied enough pressure to obtain this support when the water bubbles out between the piston and ring. This pressure is applied by the larger screw only, and must be maintained until the compound has thoroughly hardened.

The cast should be about 2 cm. in thickness at its thinnest point. It should be varnished with flexible collodian to prevent chafing of the surface. Careful measurements made of stone casts before and after swaging in both the horizontal and perpendicular diameters have revealed no distortion of the cast detectable with the Boley millimeter gage. Swagers are now available that develop tremendous pressure, some of the later ones operating on the hydraulic principle, and others of the screw-press type, which develop what is practically a hydraulic pressure because the force is applied directly to a soft rubber block which flows into the smallest crevice when under great pressure.

The large hydraulic press employed by the Krupp people of Germany is so expensive that it is out of the question as part of a dentist's equipment. A new small hydraulic press put on the market by a New York firm appears to

be practical, although I have not seen it in operation. For a number of years, I have obtained satisfactory results by using a press in which the pressure is applied through a double screw and plunger. The principle applied in this press was used in a similar press by Lyon, a number of years ago.

During the past six years, I have swaged many full upper and partial dentures of an alloy of palladium, two-thirds, and silver, one-third, and I regard it the superior of gold in every respect. The alloy is only about 63 per cent the weight of 22-carat gold.

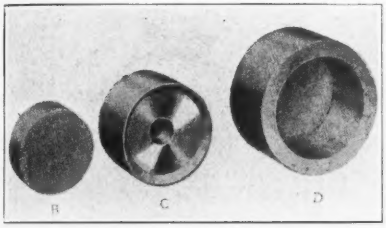


Fig. 3.—*B*, soft rubber block; *C*, piston; *D*, swager ring.

It ranks higher in thermal conductivity. These advantages are evident and indisputable facts, appreciated by the fine workman and patient alike.

Clinical and laboratory investigations made prior to 1922 led to the statement that all metals possess, in varying degree, an inhibitory action on bacterial growth, and, in this respect, the palladium silver alloy outranks the other metals in denture work. This statement still stands undisputed. I have observed only one case in these six years that has not maintained a healthy condition or improved a previously inflamed condition when this alloy was used. This is a recent case and is now under observation. The alloy has lately been improved in toughness and malleability by the addition of a small percentage more of platinum metals.

This alloy does not replace platinum at all for work in connection with porcelain, its coefficient of expansion being such as to render it totally unsuited for that work. As compared to gold, its use makes an upper denture a few dollars more expensive. Originally, it was considerably stiffer than gold alloys

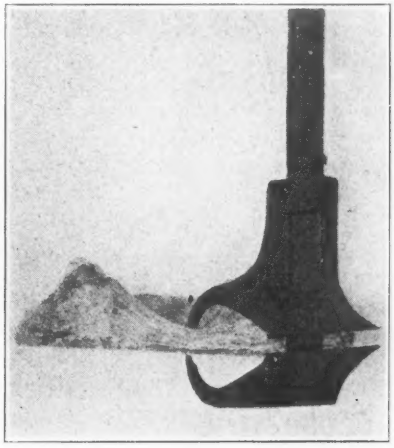


Fig. 4.—Cast only 3 mm. thick at its thinnest point. This is too thin for practical work, but a metal base was swaged over it in experimental work without fracturing the cast; which demonstrates the efficiency of the modeling compound support.

used for the same purpose, but with the technic employed, we experienced no difficulty in producing good swaging. However, many men complained that it was too hard to work, so it has been made a trifle more ductile. Our chief difficulty to date has been to produce a solder of low enough fusing to suit the average technician, and, at the same time, matching the plate in whiteness. The high fusing solder is white enough,

while the lower fusing is a trifle yellowish. This is no serious disadvantage.

Several similar alloys are now in the market, which I cannot vouch for at all. Some of them are much lower fusing, which indicates the incorporation of a base metal. The stainless steel metal bases swaged by the Krupp process have a great advantge as they are much lighter in weight than any of the noble metal bases.

In this process, a sheet of metal is clamped down over the die or cast, and is stretched (not swaged) to shape. I am told by Dr. Arstad of Norway that eight or ten casts are used up in shaping

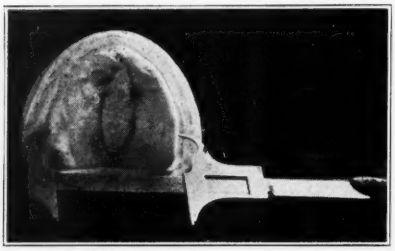


Fig. 5.—Testing the cast with the Boley millimeter gage.

one base. Instead of soldering for attachments and clasps, an electric welding process is used.

According to the same authority, the base is treated in salt fused to a liquid form, and must not be ground or cut thereafter as it is apt to corrode where ground. The extensive equipment and technic required apparently takes the work out of the dentist's hands entirely.

The technic followed in swaging the palladium alloy base is as follows. The same technic will apply to the swaging of any of the noble metals.

A modeling compound impression is made from the original cast and a second cast of artificial stone is poured. If the original cast has marked undercuts, cores, also of modeling compound, are used to obtain an accurate impression. The swaging is done almost entirely on this second cast.

The swager used is a double screw press, one screw forcing the piston into the ring and the second screw carrying a plunger which passes through a hole in the piston directly into the rubber, a soft rubber block being used. The two screws are hollow. The larger one is

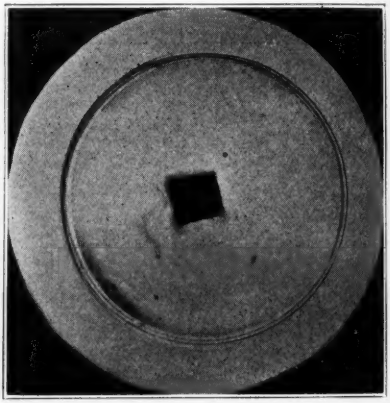


Fig. 6.—Bacterial colonies in agar-agar growing closely around a piece of vulcanized rubber in a Petri dish.

threaded both inside and out—outside to fit the top plate of the press and inside to receive the smaller screw. Through the smaller screw, the swivel plunger, which just fits the opening down through the piston, passes. The piston is concave inside to receive the soft rubber block. The ring is closed at the bottom with a well fitting steel disc. Into the hole in the piston, unvulcanized rubber is packed to prevent marring of the soft rubber block.

The case is put into the swager while the compound is still soft, and screw pressure is applied until the water and air bubble out between the piston and ring. The pressure must be maintained until the compound is thoroughly hardened, this being an important step, if we are to avoid breaking the cast.

A flat piece of 29-gage metal, cut to pattern and annealed, is placed over the cast and held in proper position with a small amount of modeling compound at the edge. Quenching in cold water is not recommended in annealing this metal. Cooling on the bench or, after a moment's wait, in warm water produces better results. The case is placed in the swager and screw pressure applied. If the metal shows a tendency to buckle over the undercuts, cut it and let it lap over, and continue swaging, with frequent annealing.

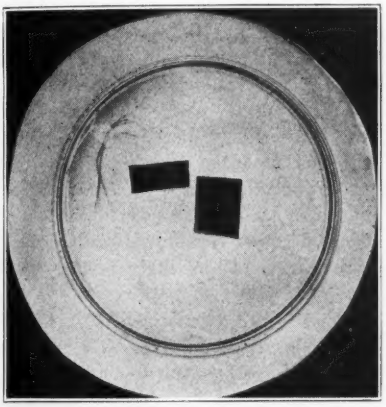


Fig. 7.—Another Petri dish similarly cultured, but with no colonies growing near to pieces of silver.

The metal is soon shaped and the overlaps are soldered with high fusing solder, the overlapped edge of metal having been previously beveled. It is well to try the base in the mouth at this stage and test its fit. If a leak is discovered, the cast can be scraped at this location to allow the metal to be swaged into a tighter fit. As it is difficult to inspect the periphery or scrape the cast while the cast is set down in the ring, we simply turn the swager ring upside down, place it in the press and apply pressure, with the large screw only, on the metal disk in the bottom of the ring. This forces the cast with its investing compound higher up in the ring for our convenience. If we get our cast too low in the ring to start with, it can be moved up any distance that we desire in the same way. Soft modeling compound must then be placed on the underside of the disk to hold it there. It is well to scrape the cast slightly across the palate from tuberosity to tuberosity to form a shallow groove, if this has not already been provided for in postdamming the impression. This groove will appear in the base and is filled with high fusing solder. In this manner, a rounding edge is obtained and the base is thickened to present an unoffending edge to the soft tissues, along this border.

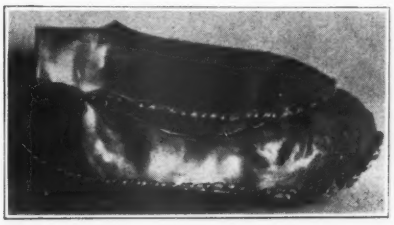


Fig. 8.—Finished base.

After finishing the base of 29-gage metal, we obtain the centric relation and set up the teeth. After the case is

tried in, the lingual contour in the rugae area is carved. The shaping of this area is important. It has more bearing on phonetics than any other part of an artificial denture, either upper or lower.

Next, a plaster impression of the entire lingual aspect is taken, including the teeth up to the occlusal surfaces. This plaster impression is removed and varnished; the wax is chilled and the teeth are removed from the base in two or three wax sections and laid aside in cold water for future replacing on the base. The plaster impression of the lingual surface is placed on the base and a mix of stone is packed in from the sides into the space formerly occupied by the wax and the teeth.

The base is now carried to the "master cast," which has been previously placed in the swaging ring, and more stone is packed in to carry it out to the sides of the ring for strength. This stone is left to harden overnight, when the plaster lingual impression is removed, revealing a reproduction of the teeth and lingual carving in stone. The lingual metal, 28 gage, is now swaged and burnished to this surface. Three strips of metal may be soldered together with high fusing solder for this lingual piece, if we wish to economize with our metal. When using three strips instead of one large piece, one piece is laid along the posterior border, and the two others, extending from the tuberosity region on each side forward, and converging to meet at the median line just lingual to the central incisors, are stuck in place with hot modeling compound. After being swaged down to place, they are soldered together. When just one large piece is used, the center is cut out of it after swaging and before soldering. The upper surface of this stone reproduction of the lingual surface is now heated with a blowpipe a little, so that it can be removed.

The lingual metal is now soldered to place on the base with the lower fusing solder, being allowed to flow in from the under side of the reinforcement, which has previously been tacked to place with solder and burnished well down to the base. The high-fusing solder referred to is a platinum colored solder with a 1,000 C. fusing point; the other, a white gold solder with a considerably lower fusing point. After the lingual piece is soldered to place, the final swaging is done, stone being first packed between the lingual piece and the base to hold the lingual piece up in place under the swaging pressure. This stone, of course, must be allowed to harden at least twelve hours before the final swaging.

The finished base is just 29 gage over practically all of its area. The lingual reinforcement does not extend over the entire palate portion making it double in thickness. It is from three-sixteenths to one-fourth inch wide, and doubles the base along the posterior border only. It is flared up from the base at the proper contour near the lingual surfaces of the teeth, and anchorages are soldered on its under side to engage the vulcanite or other material used for attaching the teeth.

The use of plenty of anchorage here and along the periphery makes its impossible for the vulcanite, lenite or similar material to draw away from the metal. The anchorage used is in the form of a spiral spring solder, coated on its outer surface. When heated, the solder flows down, attaching the anchorage to the base. By using lenite

for attaching the teeth to the base, we reduce the weight for the finished case and produce a metal denture no heavier than a vulcanite one would be for the same case.

REFITTING

Swaged bases have a great advantage over cast ones in that they can be readily refitted if it is ever found necessary.

Using modeling compound in stick form, we proceed as with an ordinary refitting impression. Into this a good stone cast is poured. This stone cast is tapered slightly toward its base so that it can be lifted out of the plaster in the vulcanite flask for swaging and again be returned to place. It is also varnished and notched to facilitate this process. After the stone has stood overnight, each tooth is heated slightly with a small blow torch flame, one at a time, and removed from its seat in the vulcanite.

After removing any vulcanite which clings to the teeth and cutting away undercuts about the seats, it will be found that the teeth will snap back into their proper places in the vulcanite. The old vulcanite is covered with thin gage casting wax and flasked in a large flask. On separating the flask, the teeth will be found embedded in the upper part of the flask and the cast in the lower as in any ordinary case.

A ditch is cut around the cast, and it will readily lift out of its seat in the plaster. It is now invested in the swager ring and the base reswaged. It may be necessary to slit and solder the metal, but it is a very simple process which consumes little time.

The cast with the refitted base is now returned to its place in the vulcanite flask, and the case is ready for packing and vulcanizing. Occasionally, after being worn for some time, a metal denture will settle down enough to cause pressure on a hard area of the palate. As it is impossible to grind away on the metal enough to relieve the pressure, another simple way has been found to obtain the result. The sore spot in the mouth is marked with an indelible pencil; the denture is placed in the mouth, and the mark will appear on it at the point where relief is to be provided.

Soft carding wax is now placed on the opposite side of the base at the point marked. The denture is next invested in plaster heavy enough to prevent its being sprung out of shape.

With a small blow torch flame, the base is heated a bit at the marked point. This causes the soft wax to melt and disappear into the plaster, leaving the base unsupported below the marked point. Then, with a small hammer and rounded orange wood stick, the metal is tapped down enough to provide the necessary relief, without the need of removing the teeth to reshape the base.

DISCUSSION

I. Lester Furnas, Cleveland, Ohio: I approve everything that Dr. Pryor has said. The palladium silver base is one of the best things that has come into denture construction in a long time, and I think that we all should use it. Dr. Pryor mentioned the steel base. It is impracticable, it seems to me, from the standpoint of both construction and use. In Europe, a great many of them are being made, but no full bases are made over there now. A great deal of difficulty was experienced with the adaptation of them. They cannot be cut down. Trimming them will cut a stone all to pieces, and if they are trimmed, corrosion results. Lenite, I cannot endorse. There are other bases, new base materials that are coming out, none of which I will vouch for, but they are all a step in

the right direction, and the time will come before long when we will have a material that will take the place of vulcanite and will be much better. I haven't seen a single case in which palladium silver tarnishes in the mouth. It stays a brilliant color, and doesn't tarnish as pure gold, even, does in some mouths. That is a thing which patients like very much. I am not entirely convinced as to the advisability of scraping the cast. We should keep away from that as much as possible for it is purely a guess what the stress on the underlying tissues may be, I mean the bony structures underlying the soft tissues. We may have more or less soft surface there and get pressure on the high points only of the bony base. It is better if we can get the impression from merely a pressure of the compound or something like the rimming technic that we have in vulcanite dentures.

TREATMENT OF ADVANCED CASES OF PERIODONTOCLASIA*

By R. G. HUTCHINSON, Jr., D.D.S., F.A.C.D., New York City

As there are no fundamental differences between advanced cases of periodontoclasia and those in earlier stages of development, it is neither necessary nor advisable to adopt radically different methods of procedure in the treatment of the various stages. No matter what stage of progress has been reached, the treatment must be fundamentally the same in all cases. Cases cannot be classified and treated by various stereotyped methods. The exact procedure in each individual case must be determined and modified to suit conditions.

The primary cause of periodontoclasia is irritation of the tissues, usually mechanical, aided by the presence of organic matter in a state of decomposition caused by bacterial ferments. The products of inflammation and other pathologic processes constitute secondary, contributing causes. Infection of the tissues occurs when the resistance has been sufficiently reduced by interference with the blood supply.

Resistance and health of the tissues depend on cell vitality, which depends on nutrition and elimination of waste products. Both depend on normal capillary circulation. It naturally follows that, in order to restore health and resistance, the causes of irritation and interference with circulation must be determined and removed at each point affected, as in no other way can the destructive action be arrested, the damaged parts be repaired and a permanent defence be established. The operator cannot cure any pathologic condition, but can remove the obstacles from Nature's path, so that the work of repair can progress without overwhelming interference. We merely assist Nature by removing destructive forces, and Nature restores health. Any other form of treatment is only symptomatic and misleading. Medication, either local or systemic, masks symptoms, making possible in some cases the semblance of health in spite of the presence of destructive forces. Such results are but

*Read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

*The papers of Drs. Hutchinson, Towner (published in the March issue), Maves, Schott and McCall were presented as a symposium.

temporary and lead to confusion and disappointment. Artificial stimulation, if not overdone, is beneficial in aiding to restore circulation. It must be borne in mind that stimulation, up to a certain point, is constructive, and beyond that point is destructive, causing degeneration of tissue. It is often more important to know what not to do than what to do.

All surgical treatment should be reduced to the simplest possible form, involving the minimum amount of interference with living tissue, and should be accomplished in the shortest possible time compatible with thorough work.

As has been said, there is no fundamental difference between the treatment of advanced cases and that of those in earlier stages, but naturally more extensive surgical procedure is involved in the former.

Occlusal adjustment is the most important step in the treatment, and after that has been accomplished and all other mechanical defects are corrected, the scaling and curettage of the teeth must be done until all calculus and necrotic tissue has been perfectly removed.

Before beginning instrumentation, the pockets should be cleaned out with a mild antiseptic solution under a compressed air spray, and then flooded with a solution of iodin in order to minimize the danger of inoculation of the tissues with the pathologic matter present. The solution which has given me the most satisfactory results is a mixture of camphor and phenol with 7.25 per cent iodin. This is put up in 1 ounce bottles by Schering & Glatz, of New York. The preparation is nonescarotic, sedative and stimulating to the tissues. Ordinary tincture of iodin should not be used, as it causes extensive sloughing.

During treatment, the pockets should be sprayed repeatedly and the mixture above mentioned applied. The same should be done at the completion of each sitting. This is the only medication that I ever use.

It is imperative to avoid all unnecessary wounding or laceration of the tissues surrounding the teeth, as instrumental trauma is as destructive as that from any other cause.

If there is extensive superficial accumulation of calculus and effete matter, accompanied by extreme congestion, and lowered vitality of the soft tissues, it is safer to remove these from the entire denture with as little interference as possible, sufficient time being allowed for recovery of the tone through restored circulation, before deep scaling and curettage of the roots is begun. I then operate on as many teeth as can be completely cared for at each sitting, until the entire mouth has been treated, being careful not to overdo it, as results will be better if the treatment is supplemented at a subsequent sitting, if necessary, than if the recuperative power of the tissues is overtaxed.

If the alveolar process is necrotic it must, of course, be cut away to the point where there is ample circulation, but great care must be exercised to avoid injury to the living bone, or recurrent necrosis will result.

It is seldom if ever necessary to resort to the removal of overlying soft or hard tissue in order to reach the infected areas, if the operator possesses the degree of skill and knowledge which justifies him in undertaking such treatment. All can be done by the sense of touch.

It is impossible to describe the operative technic adequately. That must be

demonstrated, and even then it is impossible to impart to any one a complete knowledge of just what is being done with the instrument.

Each operator must develop his own technic, and it requires years of patient work to bring it to a point approximating perfection.

Only experience enables one to know at once what to do and how to do it with apparent ease and certain success. This is fundamental and applies to successful accomplishment in any line of endeavor. The practice of periodontia is no exception to this general rule; on the contrary, I know of no branch of dental practice in which it is more applicable.

Success depends entirely on the good judgment, knowledge and skill of the operator, provided the patient possesses the necessary recuperative power, and will cooperate after being properly instructed in the care of the mouth. Unfortunately, patients frequently nullify, to a considerable extent, the beneficial results of correct treatment by their mental and physical indifference or active antagonism, both during treatment and subsequently.

No operator can attain perfect results without the earnest and intelligent cooperation of the patient. In justice to all, this should be distinctly understood before beginning the treatment of a case. Otherwise, the operator is apt to be blamed for recurrent pathologic conditions which are the direct and inevitable result of errors of omission or commission on the part of the patient. In all cases, the patient must be properly instructed in mouth sanitation, kept under supervision and given prophylactic treatment at proper intervals. He should also be told that restoration to health does not create indestructibility of the tissues and that a recurrence of the pathologic condition will certainly result from neglect or injury, just as it did in the beginning.

The occlusal contacts will wear away again and need readjustment just as any other mechanism will do, and unless adjustment is properly made when needed, trauma will be the result, with its train of consequences.

As we are dealing with a mechanism which must be regarded as a unit, and not an aggregation of units, it is imperative to replace lost parts in order to prevent the destruction of the whole by operation of the mechanism with parts missing. This must be done in such a manner that function will be properly performed, sanitation maintained and undue injury prevented, in both the construction and the operation of the restorations.

Systemic disturbances have a decided effect both on the progress of the pathologic process and the recovery of health, but these conditions are, in the great majority of cases, secondary and will be cleared up by treatment of the primary local lesions.

In cases in which the systemic conditions have reached an advanced stage, there may be need of systemic treatment in order to restore health, but this is the function of the medical practitioner and should be left to him.

As all operative procedure in the mouth is surgery, pure and simple, it is wrong to designate only radical operations as surgical. This leads to much confusion and misunderstanding. Both conservative and radical operations are surgical, and the unqualified term "surgical treatment" should not be used

exclusively in connection with radical operations.

The definition of surgery is "the branch of the healing art that relates to external injuries, deformities and other morbid conditions to be remedied directly by manual operations or instrumental appliances."

The ruthless destruction and removal of large areas of healthy soft and hard tissues is unnecessary, unjustified and pernicious. Good surgery aims at conservation of living tissue, not destruction. Competent periodontists can successfully treat cases without resorting to such practices, and I believe this method to be dangerous and harmful, even when employed by a skilful operator.

On the other hand, mere superficial stimulation by mechanical means is inadequate. It undoubtedly will increase the tone and resistance of the tissues, but cannot correct mechanical defects which cause trauma nor remove pathologic tissue which is deep seated and attached to the hard tissues.

The beliefs and opinions herein expressed are based on the successful results obtained during more than thirty years of intensive practice and clinical observation. During that period, there has been no deviation from the one course.

Many experimental methods have been advocated and tried by others, only to prove worthless and fundamentally unsound, being foredoomed to failure.

Some men in former generations have known and practiced the methods successfully used by many of us. These methods are based on truth. Let us not waste time on experiments, but adhere to the methods which have proved safe and sane.

225 Broadway.

REGISTRATION OF CENTRAL RELATIONSHIPS OF THE MANDIBLE TO THE MAXILLAE IN DIAGNOSING OPEN BITE CASES*

By THEODORE W. MAVES, D.D.S., Cleveland, Ohio

I WISH to call attention to the great importance of the fundamentals underlying individual restorations and bridgework, whether fixed or removable, necessary in certain cases to maintain the health of the periodontium after the completion of treatment.

The success of the case which requires restorative dentistry, after periodontal to the periodontist's opportunity to see treatment, will be in direct proportion to it that the fundamentals of restorative dentistry are observed. Otherwise, the underlying structures may again become diseased and the periodontist will be disappointed in the outcome of the case.

Bridgework and individual restorations cannot yield under stress, and any force which the bridge or restoration sustains is immediately transmitted to the abutments and indirectly to the underlying structures. If, because of any serious error in the placing of the teeth

*Read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

or the formation of the facets of the teeth, the force is wrongly directed, the abutments as well as the underlying tissues will be destroyed. No form of mechanical engineering, however intricate, will long preserve the abutments against the continuous exercise of a wrongly directed force or a force which is out of proportion to that received by the rest of the dentition.

This brings us to what the fundamentals should be and which should be important, as well as common knowledge, to the periodontist for the successful prognosis of his case after the completion of his treatments, when restorations are necessary.

A large portion of failures in bridgework, either fixed or removable, attributed to overloading of the abutments are directly due to the ignoring of the components of mandibular guidance. When we establish functional freedom in harmony with condylar and incisal guidance as required by each type of masticating unit, we will have success in all the cases that we are called on to restore to functional occlusion. The so-called open bite case is the most difficult, for, if all the movements of the mandible are not recorded and successfully carried out in the occlusal anatomy with all types of restorations, we shall subject all restorations made and all remaining teeth to disharmony and interference, resulting in lateral as well as vertical stress, and bringing about periodontal disease and ultimate loss of the entire denture.

Paul R. Stillman's ideas on this subject are so important that they should be common knowledge to all periodontists, as well as to prosthetists. He states:

> It unfortunately happens, in many instances, that the position of the teeth or their cusp form is such that stress brought upon them is far in excess of the presumptive capacity of the supporting tissues, or is at least out of proportion to the stress which is brought to bear on the other teeth in the mouth. Under such circumstances, wear of occluding surfaces may take place in such a way that the original stress is modified to an extent which brings it within physiologic limits, or reduces it to the level of the stress to which the other teeth are subjected. If such functional wear occurs, no harm will follow, and the stimulation of the surrounding tissues, as previously outlined may take place. Such wear is seldom seen in the mouth of the average city dwellers of today.

It therefore follows that the element of excessive stress, once occurring in such mouths, is continued indefinitely, as it is practically never self-limited. One of two things happens: (1) given heavy alveolar support and high tissue resistance with disproportionate stress, there occurs a disturbance of the pulp circulation, or (2) given a less highly organized alveolar support with stress in excess of physiologic capacity, disease of the periodontal tissues ensues.

The *modus operandi* of these two widely dissimilar pathologic phenomena has its starting point in a disturbance of the circulation of the pericementum.

This tissue, which has been overlooked by most students of periodontal pathology, with the notable exception of Box, carries within itself the explanation for most of the phenomena of periodontal disease and many of those of pulp pathology. When stress, whether normal or excessive, is brought to bear upon a tooth, its primary effect is on the pericementum. The compression and stretching of the pericemental fibers affects first of all the blood vessels. The primary result of this circulatory change seems to be the production of a hyperemia. In the type of tooth having a heavy alveolar support, this hyperemia has its most marked manifestation at the apex of the tooth. It affects the pulp circulation, if we may make a diagnosis by

classic symptoms of dental pulp disease. This disturbance gives rise to sensitiveness, as for instance, to thermal changes. It may go on to the acute pain characteristic of pulpal disease; it may, and frequently does, lead to death of the pulp.

We are speaking here of teeth which have no caries and no advanced periodontal disease. The same prognosis can follow an individual restoration as well as a complete mouth restoration when teeth are present. Such cases are not a rarity in dental practice, because of the absence of the better understood and more common exciting causes of such symptoms. Such teeth, if treated in time by the correction of the traumatic occlusion, will rapidly become comfortable through subsidence of the symptoms of inflammation.

In the other type of case mentioned, in which the alveolar support is inadequate, hyperemia seems to arouse the activity of bone-destroying cells, and alveolar resorption and rarefaction begin. As this occurs, there is a structural change in the pericementum, with usually a perceptible congestion of the tissues near the alveolar crest. The congestion results in lowered resistance, and makes possible the entry of bacteria. With this event, the complex process of periodontal disease is under way.

It may be noted that, in both these types of cases, there is an excessive occlusal stress which nature has failed to relieve through the medium of attrition. In the first type of case, we have a disturbance due to the fact that the periodontal tissues provide ample mechanical resistance against disproportionate, and therefore excess, stress. In the second type of case, we have periodontal disease because of the inadequacy of alveolar support, with pulp symptoms at a minimum. When we add to these two the types in which the capacity of the alveolar support is only slightly below the demand made on it, or in which the excessive stress is dissipated through natural wear, the stress is thus brought within the capacity of the alveolar structures, we have summed up the three fundamental results following on the introduction into the dental mechanism of the agency commonly called traumatic occlusion.

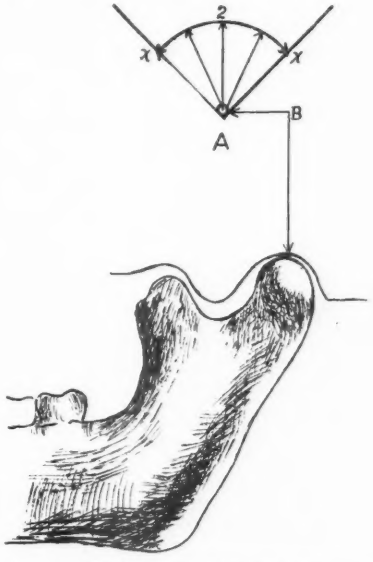


Fig. 1.—Gothic arch obtained by movements of the mandible, starting from central occlusion.

We can readily appreciate the foregoing as knowledge fundamental to the successful accomplishment of restorative dentistry, when coupled with the conclusions based on the research that M. M. House has given the dental profession, namely, that the occlusal surfaces are in the form of arcs and curves and not planes, also that by giving a small

amount of freedom in central occlusion with the rotary grinder, we shall reduce vertical stress as well as periodontal disease resulting from this cause. The wearing of the contact surfaces and cusps of the teeth brings about proportionate changes in all parts of the masticating as well as of the facial tissues and character of expression. (Fig. 1.)

In the given case selected to carry out this technic, the posterior teeth distal

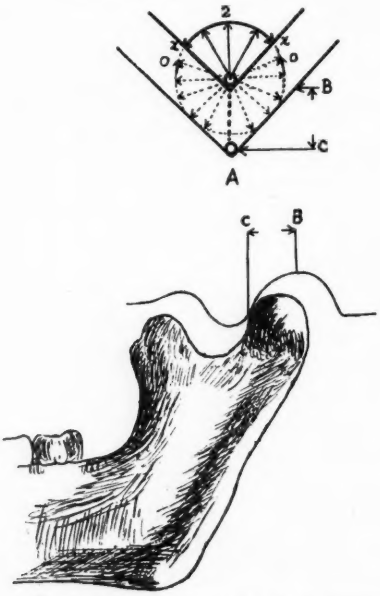


Fig. 2.—Gothic arch obtained by movements of the advanced mandible in an open bite case.

to the cuspids in both arches are to be restored to proper function. As the anterior six teeth in both arches do not necessitate restorative work, they will serve as our incisal guide in the protrusive movement, and the cuspids will tend to control the lateral movement of the mandible. The reason for opening the bite in this particular type of case is to replace the occlusal wear of the posterior teeth; to relieve the leverage and wear on the anterior teeth, and to place all teeth in both arches in occlusal harmony and the best balance possible with the least amount of cusp interference.

When the case was presented for diagnosis, the two lingual cusps for the two upper bicuspids were fractured from occlusal wear, and the lingual roots of both upper first molars were denuded of process for one-third their length. This was due to terrific occlusal wear and elongation to maintain occlusion, with periodontal disease on the mesial side of both upper first molars and also the anterior six teeth, the latter being due to anterior leverage.

Assuming that the case at hand has been successfully diagnosed and treated for the removal of all focal infection and the remaining tissues have been placed in a state of health, we first make study models of artificial stone and mount them in an articulator for the study of cusp interference and trauma on the remaining teeth before any restorations are made. The relief of any tooth or teeth which function in traumatic occlusion or cusp interference is important at this time, because, if this is not accomplished the particular tooth or teeth will continue to function in traumatic occlusion after the restoration is made as it did before the restoration was attempted. This applies as well to cases in which the bite is not opened. This method of grinding certain points and surfaces of the teeth is best accomplished by following the technic recommended by Paul R. Stillman[1] and others.

1. Stillman, P. R.: What Is Traumatic Occlusion and How Can It be Diagnosed and Corrected? J.A.D.A., 12: 1330 (Nov.) 1925.

After applying the foregoing principle in certain types of cases, we carry out a second important step, namely, we build on the occlusal surfaces of those teeth requiring this without increasing the length of the crown of the tooth to such a degree as to increase lateral as well as vertical stress detrimental to our restorations.

After the relief of cusp interference, we proceed to the necessary cavity preparation on four teeth in the lower arch, selecting two lower second bicuspids and two lower second molars. After their completion, we select four opposing teeth in the upper arch and proceed to cavity preparation on the upper teeth, to carry out the plan of compensating for occlusal wear.

The next step is to determine the distance the bite must be opened to obtain the best balance possible and functional occlusion harmonious to all the movements of the mandible. An important fundamental in opening any bite is to establish the correct relationship of the mandible to the maxillae at the required distance. If the central relationship is not registered by the patient, and the operator proceeds to build the case with no accurate starting point as central relationship, the occlusal relations of the entire restoration are placed in disharmony. Periodontal disease, with failure of the case, results.

The greatest number of our failures in open bite, crown and bridge, and partial as well as full denture construction have resulted from the lack of this knowledge and failure to record this important fundamental. In cases of crown and bridge restorations in which no attempt has been made to incorporate this principle, we have introduced traumatic occlusion rather than accomplishing its relief, and disease of the underlying structures has resulted in time, with great discomfort and lack of proper mastication.

Up to the present time, there are two methods which have been proved a success in recording the central relationship of the mandible to the maxillae: the first, known as the gothic arch tracing, given to the profession by Dr. Gysi of Switzerland, and the second, known as the Needles method, given to the profession by John W. Needles, of Kansas City, in which three pins are employed in the upper modeling compound bite block and three tracings registered in the lower, three important fundamentals being thus established: central relationship, lateral movements of the mandible and condylar inclination harmonious to the case.

I shall deal with the first method, known as the Gysi gothic arch tracing, and I wish to recommend the writings and principles given the profession by Dr. Gysi in regard to mandibular movements and their registration by the extra-oral method, and also his technic; for not one of his theories or principles given have been disproved, and often they have been misunderstood by some of the profession.

The detail of this technic is not important. The periodontist should emphasize these fundamentals: (1) central relationship, (2) condyle path tracing and (3) right and left movements of the mandible harmonious to each given case.

Central relationship is obtained by making modeling compound bite blocks with a tracing pin, as shown in Figure 3, and transferring to the mouth the gothic arch tracing made by the patient, and also obtaining extreme right and left movements of the mandible as shown on the tracing made on the lower

anterior bite block (Fig. 3). Condyle paths are obtained by placing the Gysi face-bow in position and by a card tracing made by the patient, as shown in Figure 4. The right and left control of the condyle path or Bennett movement is obtained by placing beeswax

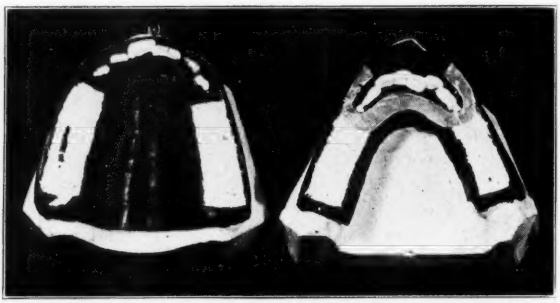


Fig. 3.—Bite blocks.

bites in the mouth with modeling compound bite blocks in place, as shown in Figure 5.

The occlusal surfaces are now carved to functional occlusion, harmonious to all movements of the mandible, and are transferred to the articulator from the patient. By the different movements of the articulator, the cusps, marginal ridges and all occlusal surfaces are placed in harmony with central relation, right and left lateral movements, incisal guidance and condyle paths; which practically eliminates lateral interference as well as vertical stress in the occlusal carvings, as the case best permits. (Fig. 6.)

The wax patterns are now removed and invested, and the cast is fitted on the amalgam dies and then placed in the articulator.

A most important fundamental in occlusal anatomy is functional freedom in central occlusion as well as lateral. This can be obtained by the use of a House rotary grinder, placed on the upper bow of the articulator, and the use of carborundum powder mixed with an adhesive powder.

Since the occlusal surfaces of all teeth in all stages of wear are in the form of arcs and curves, as is definitely proved by Dr. House, in the research completed at Deaner Institute, and it is known

Fig. 4.—Establishing condyle path tracings.

that 75 per cent of all restorations, including inlays, crowns, bridges and partial as well as full dentures are made with occlusal interference and also that trauma is introduced rather than relieved, it is most important to insure this freedom in occlusal surfaces. This can be most successfully accomplished without destroying the occlusal carvings given lateral as well as vertical freedom in central occlusion, which is so important to maintain the health of the periodontium, as well as for the relief of traumatic occlusion.

Fig. 5.—Beeswax bites.

Owing to the fact that articulators are just means to aid in obtaining a desired result, provided the proper registrations have previously been made by the patient and recorded on an articulator made to function in accord with registrations, we now place the eight abutments in cast form on the teeth in the mouth for a final check-up, having the patient make all functional movements; and, if necessary, we regrind to overcome any slight interference noticeable, in order to obviate any slight errors of the articulator, as well as those involved in registration and transfer.

From this point, we proceed to restore the remaining teeth necessary, having established eight abutments as our guide, with occlusal structures in harmony with the mandible in all its movements, and thereby restoring the teeth of the mandible to proper function, with the highest regard for all underlying structures, whose maintenance in health and function should be regarded as of the greatest importance. Figure 6 shows the

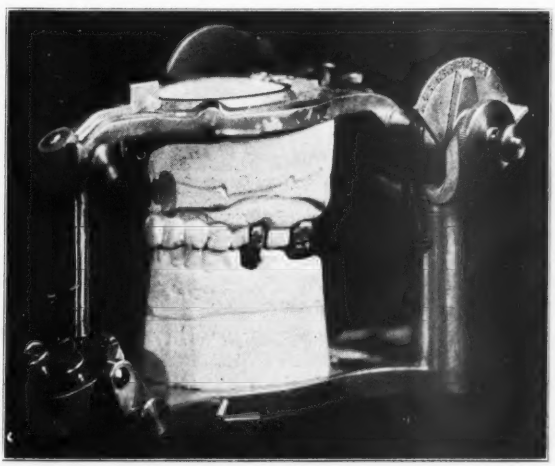


Fig. 6.—Cast transferred to articulator.

completed case carried through with this technic, and it has proved more satisfactory and given greater comfort to the patient than many past cases attempted with other methods. Figures 7 and 8 represent practical cases before and after completion, giving the best balance possible under the existing conditions.

Another important fundamental is the difference between the ranges necessary for grinding to harmonious occlusion in an open bite case, in which the mandible is not advanced and restored to existing conditions harmonious to the individual, and in a case in which the mandible is advanced and then built to a condition giving the best possible balance to an arbitrary condyle path.

Dr. Gysi's work, which includes the gothic arch, has been one of the greatest contributions to the dental profession. He has illustrated clearly the movements of the mandible in all its ranges, starting from a point known as central occlusion. This registration can easily be made by the patient in any open bite case, as illustrated before, and also as represented in Figure 1*A*, the point *B* representing central occlusion, which is also represented when the head of the condyle is in the base of the glenoid fossae, as shown in Figure 1. The extreme lateral ranges both right and left are shown in Figure 1*A* by the two lines X, as well as the ranges of occlusion necessary to be ground in, which are harmonious to the existing conditions starting from the point *B*, representing the new central relationship of the mandible to the maxillae, or central occlusion as represented by the arch of the circle 2. If all restorative cases in crown and bridge work and in operative dentistry as well as partial and full dentures observe this fundamental, all underlying structures will be maintained in a state of health, traumatic occlusion will be reduced to a minimum and prognosis will be favorable in open bite cases. This illustrates the gothic arch when the mandible is not advanced and the case is ground to existing conditions, with no cusp interference with harmonious occlusion.

Fig. 7.—Case before and after correction.

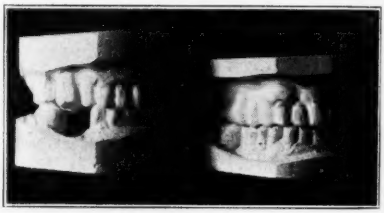


Fig. 8.—Case before and after correction.

Let us now consider a case in which the bite is opened and the mandible is advanced, building the case to an arbitrary condyle path and allowing the occlusion to be the main guiding factor in obtaining the best possible balance. If a registration of the foregoing condition is made by the patient when the mandible is advanced, we shall obtain the gothic arch as shown in Figure 2*A* and from *B* to *C* in Figure 2, which is the same distance as from *B* to *C* in Figure 2*A*. The new central relationship of the mandible to the maxillae in this position will be at the point *C*. We also realize that the patient can not only move the mandible forward and laterally as shown

in the circle *2*, Figure 2*A*, but also can retrude the mandible and have ranges of occlusion to be ground in distally from point *C*, Figure 2, until the head of the condyle is located in the center of the glenoid fossae at *B*, Figure 2. Therefore, the ranges of occlusion necessary to grind in a case calling for restorative dentistry in which the mandible is advanced will necessitate the grinding in of all of the ranges in segment *2*, Figure 2*A*, plus the different ranges and directions from *O* to *O*, Figure 2 *A* or the entire circle starting at the point *B*, Figure 2 *A*, the result being that we have flat occlusal surfaces to obviate cusp interference if we wish to avoid the introduction of traumatic occlusion. If the case is not ground in to all the ranges and directions shown in Figure 2 *A*, and the cusps are left to maintain the mandible in its new relationship, we shall introduce traumatic occlusion rather than relieve it, and the periodontium will suffer the strain, with periodontal disease resulting.

For the foregoing principle, I wish to express my appreciation to Dr. Balters, of Berlin, Germany. Extensive open bite cases in restorative dentistry have proved a greater success, building to existing conditions harmonious to the individual, when the gothic arch tracing and central relationship with condyle path records have been incorporated in the occlusal relations of each individual case.

ONE PIECE CAST REMOVABLE APPLIANCES*

By CARLOS H. SCHOTT D. D. S., Cincinnati, Ohio

AS conservation is or should be one of the paramount aims of dentistry today, we must consider pulp conservation in its relation to certain types of restoration work.

The deliberate and malicious destruction of pulps in the preparation for certain types of attachments must be regarded as ancient and unintelligent. Such types of attachments as the "split pin and tube," the "bar and casing," the "ball and tube" and the many forms of divided male element internally placed within the female element or sleeve fixed within the tooth, all, if they do not require devitalization, usually require the overclose relations between the inlays and the sensitive tooth structure. Such inlays must have sufficient frictional contact with the cavity walls to insure mechanical strength, which compels the operator to expose much freshly cut dentin, with an insufficient wall of dentin between the inlay and pulp that, in spite of Nature's compensatory formation of secondary dentin, many of these pulps, with the added shock and stress of carrying the attachments, become abnormal and then pathologic. I have observed that this is more commonly true in the cases in which perfectly sound teeth are cut into than in those in which large fillings have been placed for a long period of time and the receded pulp protected with a secondary dentin and a greater mass of cement; which is objectionable when a glovelike fit is required for greater frictional con-

*Read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

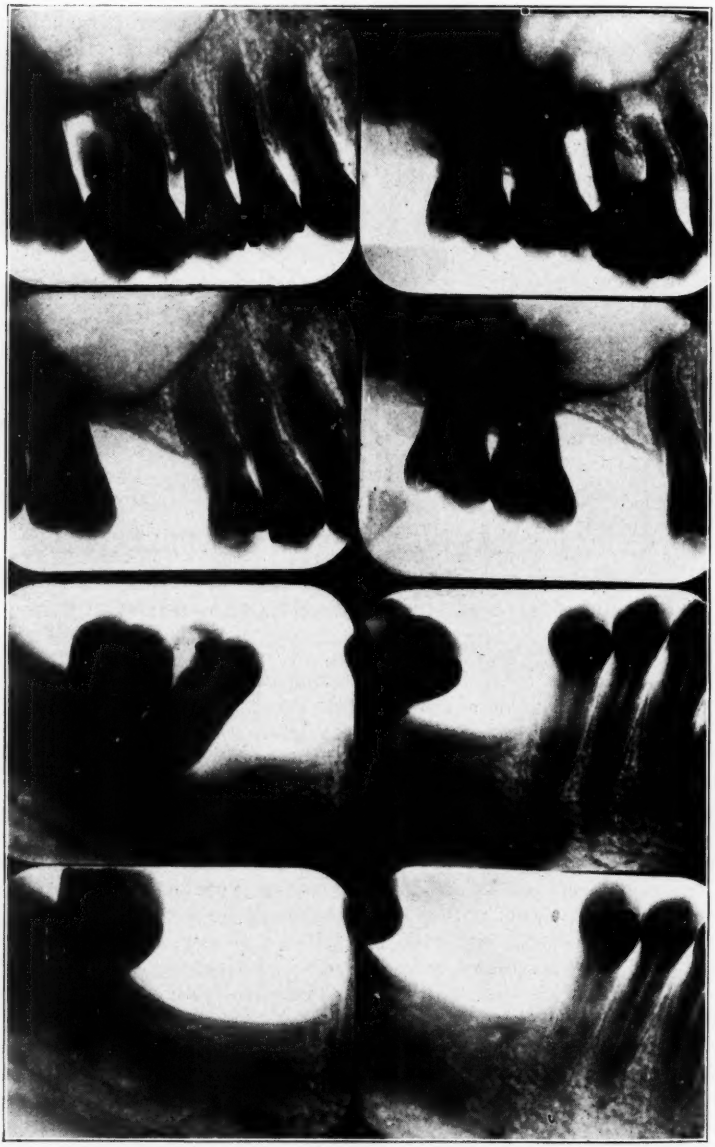


Fig. 1.—Bone repair following extraction of infected teeth and periodontic treatment.

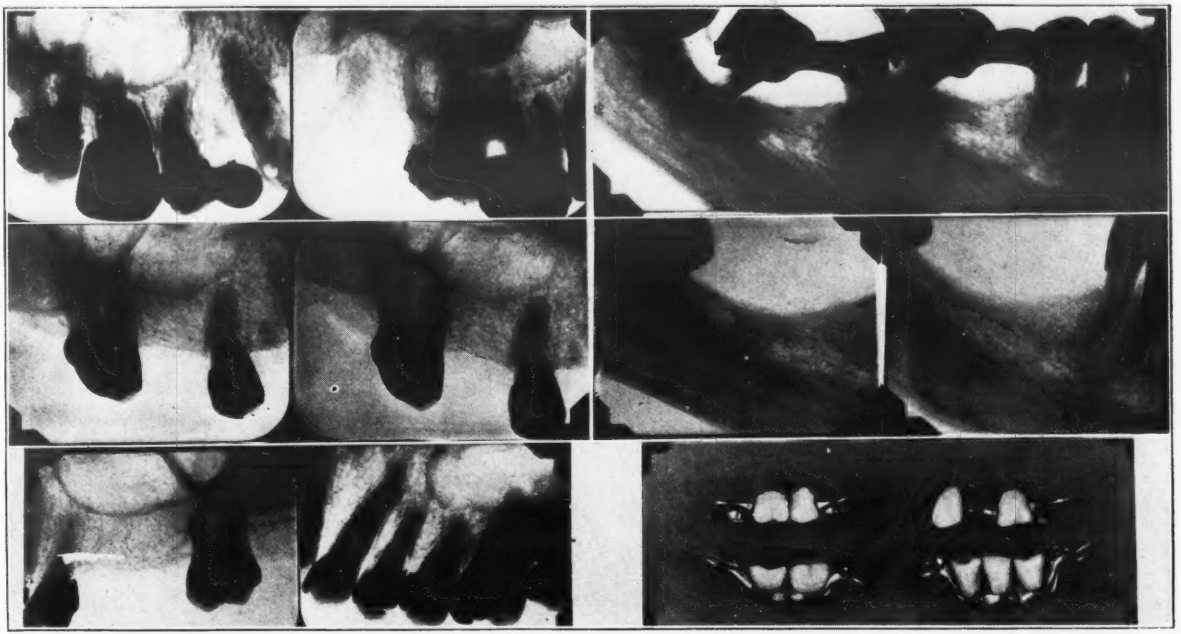


Fig. 2.—Bone repair following removal of infected teeth and periodontic treatment, and appliances which have supplied spaces for the past two years.

tact, where inlay or filling is used as an attachment for restoration.

In considering clasps as our only other means of retention, we must consider the flat wrought clasps which can be made to fit, but commonly do not, and therefore act as food traps and serve to retain stagnating fluids. The half round wire, the flattened round wire and the separately cast clasp, all with or without stress breakers, have their place. "A place for everything and everything in its place" is a quotation that may well be applied to our dental restoration work.

Much has been contributed toward raising the standards of dental restorations. The dentist should be primarily a good diagnostician and prognostician, and be capable as an architect, or at least able to assist in making the designs for rebuilding. He should be capable of deciding on the ability of the foundation structures to withstand the stresses to be placed upon them, and of selecting the type of restoration most adaptable and most agreeable to the maintenance in good health of those supporting structures. If the dentist does not do the work himself, he should be able to advise as to type and design; for the degree of success in our restorations is dependent on the intelligence used in selecting the proper type of appliance, and on the maintenance of the occlusal harmony and health of the supporting structures.

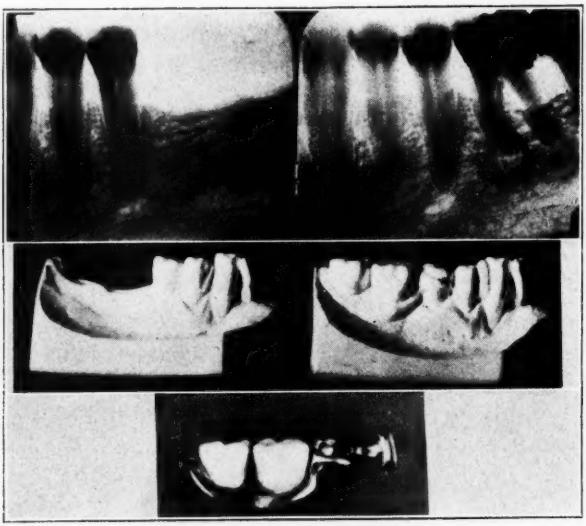


Fig. 3.—Bone repair after extraction and periodontic treatment, and unilateral bridge which has been worn for three years.

I realize that the subject which I am presenting is indeed a large one and subject to great comment and criticism, and I am reminded of the saying "Fools rush in where angels fear to tread."

Whether we choose to use one-piece

castings or assembled cases is a matter for individual decision. I have experienced my greatest measure of success with the one-piece cast method and shall present my experiences with this type of restoration. After all, presentations on practical subjects, such as this, must be an expression of our personal experiences and observations.

was decided that I should be the patient. The simplicity of his method appealed to me, particularly because, in making the entire case over one model, it seemed to me that the chance of changes taking place was greatly lessened. Especially is this true now, with the improved materials we have. I am today wearing the same type of bridge, having made

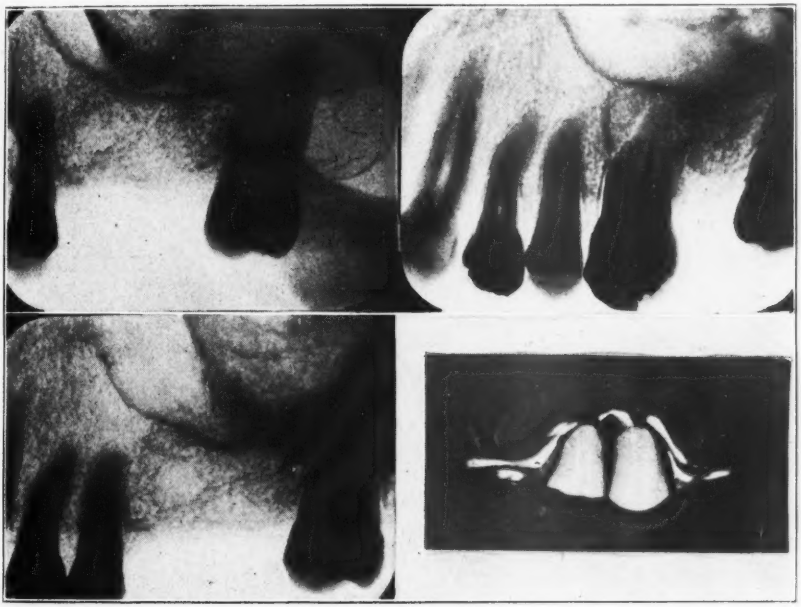


Fig. 4.—Bone repair following extraction and periodontic treatment, with the cast appliance which has been worn for three and one-half years.

Almost three and one-half years ago, I determined to know something about the Akers' technic in the construction of removable bridges and partial dentures, having previously tried out assembled cases according to Nesbett and others, with varying degrees of success. Dr. Akers kindly offered to demonstrate his method, and as I had a space in my mouth which needed a restoration, it

another one only because the bridge was placed soon after extraction. The fit and comfort otherwise are very satisfactory, and it still can be worn.

With my associate, Dr. Roche, I have designed and made about 200 one-piece cast cases in the past three years. After a careful check-up of more than 100 of these cases, it is my conclusion that this type is more practical and more accept-

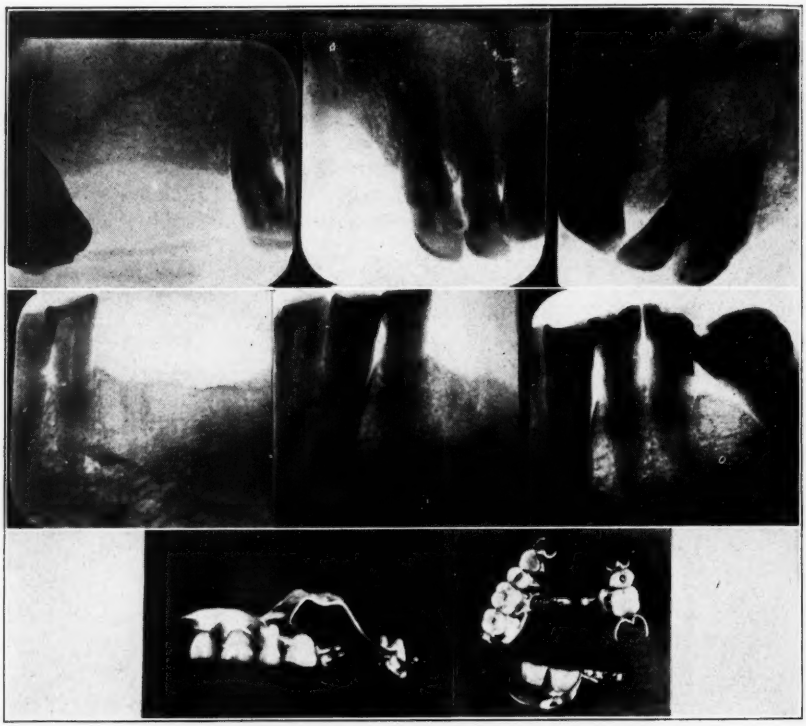


Fig. 5.—Bone repair after extraction and periodontic treatment, and appliances which have been in use for three years.

able to the teeth and supporting structures, when removable work is indicated, than any other type of restoration I have used. They are constructed with greater conservation of abutment teeth, without mutilation, as well as greater pulp conservation; decidedly better opportunities for sanitation; more beneficial splinting effects on teeth where considerable supporting structure has been lost through periodontoclasia or other conditions, thereby establishing better though smaller contacts with supporting teeth. Normal occlusal relationship is established where teeth have drifted, which is important in bringing about the improvement of the supporting structure both hard and soft. A much better artistic and esthetic effect is obtained, with smaller clasps and less bulk, and with no pain to the patient and much less time in the chair. There is also opportunity for greater accuracy in fit.

It is my purpose to try to prove that these statements are true by my clinical case reports and illustrations.

The construction of the one-piece cast type of work not only does away with a succession of impressions, but also avoids

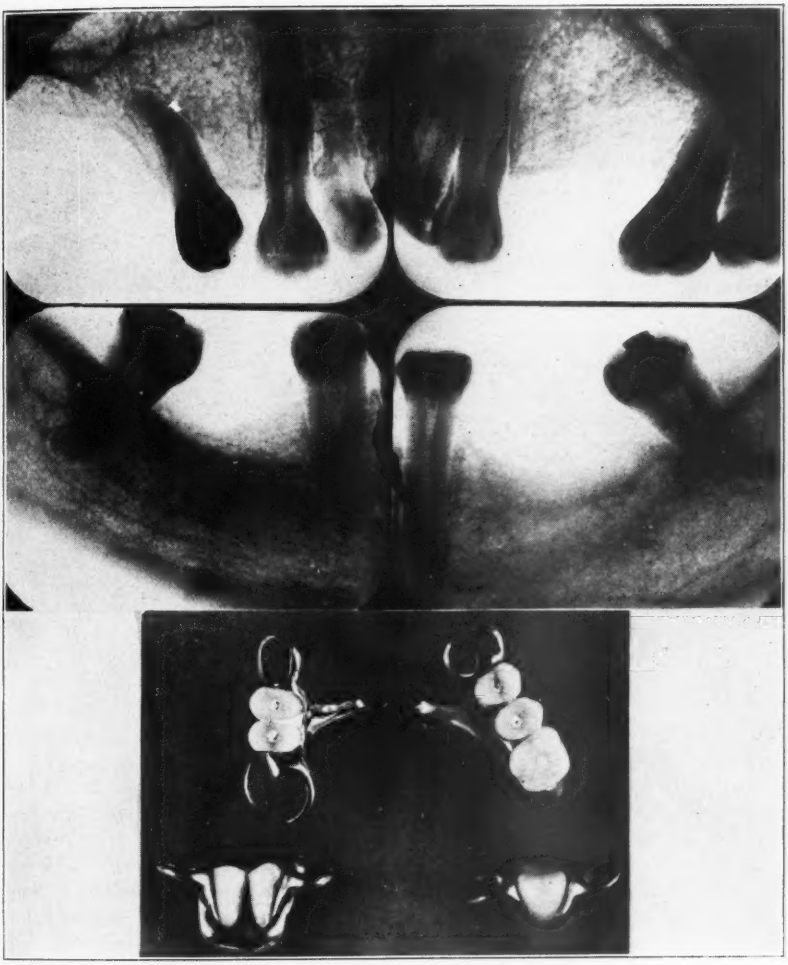


Fig. 6.—Conditions of the supporting bone and teeth, and appliances which have been worn for two years.

a number of soldering operations, which subject the case to a greater possibility of changing the relation of assembled parts. With the proper designing of clasps to avoid impingement on vulnerable parts of the teeth and with proper location and provision for occlusal rests, the case becomes practically a fixed bridge, with the added advantages of having greater strength, of eliminating the solder and of being removable and cleanable out of the mouth.

Fig. 7.—Bone repair after tooth extraction.

One of the first things to be done before the impression is taken is to provide for occlusal rests and polish the teeth thoroughly, in addition to overcoming or repairing all imperfections in the teeth to be clasped. The inside of the clasps and finished case must be equally well polished and kept so, and these clasps should make contact with a minimum of tooth surface. To prevent pressure on the underlying tissues is most essential where tooth supporting restorations are used. The appearance of the soft as well as the hard tissue around the supporting teeth I have found to be more nearly normal, and there is practically no irritation of soft tissue or resorption of hard structure when the appliance has been properly made and adjusted and the occlusal harmony and balance has been restored; a most important factor.

I believe, as suggested by Dr. Hirschfeld recently, that in many instances, unilateral mastication is a contributory factor in cases of predisposition to periodontoclasia, and many such cases could be avoided by restorations before the occlusion on the opposite side has been seriously traumatized. In many cases in which all the molars are lost on one side, I find the unilateral bridge successful to a degree, though this type of restoration is frequently most difficult to make and the least satisfactory of all of our restorations or dental crutches; for, after all, that is all they can ever be and they must be accepted as such. The use of the unilateral bridge is not advisable

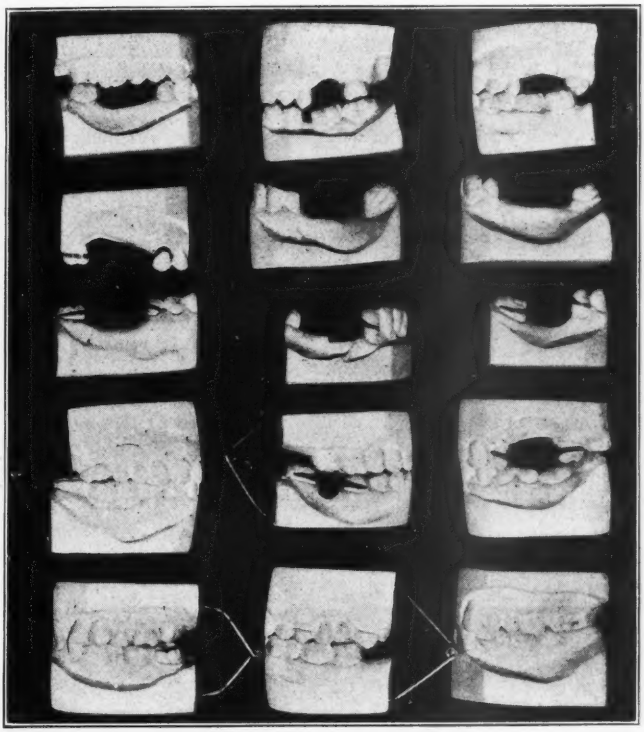


Fig. 8.—Steps in the construction of removable appliances.

in all cases because of the physical conditions and, in many cases, for psychologic reasons. The devotees of stress breakers on partial restorations would, of course, argue for the massaging effect of the saddle on the ridge and against the pull on the clasped teeth. I cannot see that there is much of an advantage, since it is always necessary to place some form of clasp on a tooth on the opposite side, with the overstress on the saddle side and the unequal pull during mastication of the clasp attached to the bar on the other. It seems to me merely a transfer of trauma, if trauma cannot be entirely overcome. It is a matter of studying the case for the selection of the type most conservatively adaptable to the case in hand.

In considering the various types of practical ridge supporting or tissue bearing restoration, we must not fail to credit the many whose names are familiar to us, who have given us attachments compensating for and relieving stresses on attachment teeth; but I have seen few that will last a great length of time without remaking or readjusting to prevent abnormal pull and stress on the attachment teeth as the case settles. I have never seen a ridge supported partial restoration which did not settle

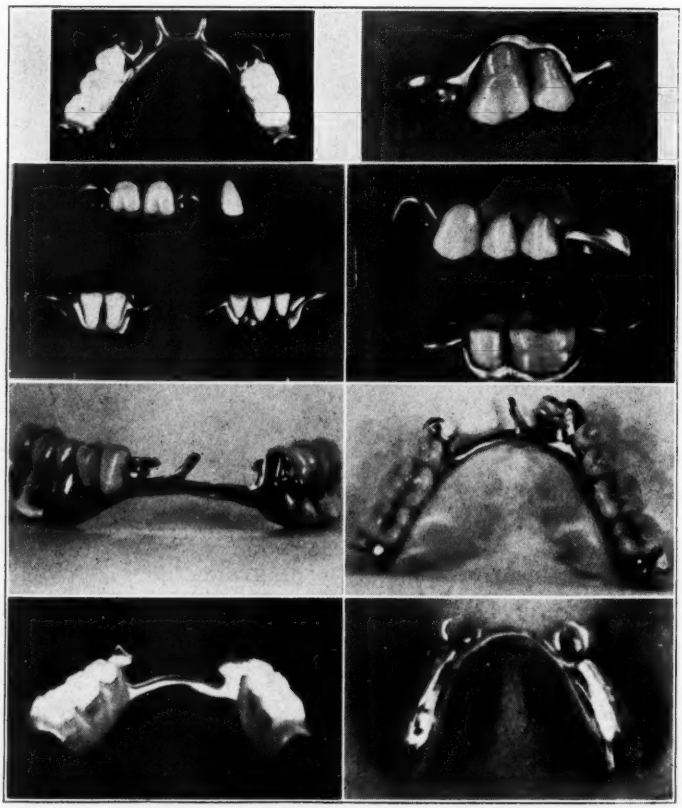


Fig. 9.—Types of removable restorations.

some, the degree of this settling being dependent on the size and character of the ridge to be saddled, particularly where the occlusal stress is great. It is my experience that the wire clasp requires more readjustment than the cast clasp, no matter how well it has been fitted. Clasps carried by stress breakers and subjected to unequal stresses on one side or the other are often in need of repair at the point of attachment to the saddle or superstructure. In my opinion, the restoration is more firmly fixed when the cast clasps are used and there is less chance of movement on the supporting teeth than when the wire clasps are used. I do not want to infer that there is no place for the assembled case method, but I rarely find a case calling for removable appliances in which other methods are more applicable than the one-piece cast type.

The one-piece casting was the subject of a debate between Drs. Akers and Nesbett before the Illinois State Dental

Society which brought out much comment and criticism.

It is not my purpose to mention all of the points of criticism brought out in that discussion. Dr. Nesbett says, in commenting on the popularity of the Akers technic, that one of the reasons for this popularity is that this technic has been "sold" to the profession with an assiduity and a resourcefulness in merchandising that has never been applied to any previous procedure. I cannot agree with Dr. Nesbett in this, as I believe that it has been "sold" more on its merits. To my knowledge, there has never been a greater organized effort made by any group of technicians than has been made by the group trained under Dr. Akers. Through the training

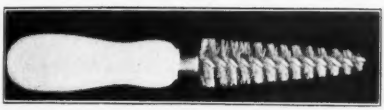


Fig. 10.—Type of brush which should be used on every clasp case.

classes, they are working always to improve and perfect their methods, thereby giving a real service to dentistry.

Another comment that has been made editorially is that its popularity was due to its promotion by the commercial laboratory. Those who try to do clean work conscientiously under intelligent direction are surely to be commended. We should be a much more nearly toothless race than we are if we depended entirely on men who, having no technicians, are either too busy in other phases of operative dentistry or are disinclined, for various reasons, to do laboratory work.

I wrote Dr. Akers asking him what he had done by way of assembling clinical and roentgenographic evidence in making case histories, studies and records of the effect of his type of work on the supporting structure as well as on the teeth. Dr. Akers wrote as follows:

> I regret very much that I have no data available in the way of X-Rays, case histories and photographs showing how well received these cases are by the mucous tissues of the mouth and abutment teeth themselves. However, I can state, and this you no doubt have corroborated in your own experience, that the appearance of the gums and the abutment teeth is very gratifying indeed. This I attribute quite largely to the proper trimming of the impression to restore proper interproximal spaces and to the occlusal lugs and other provisions to prevent settling.

The Akers-Nesbett debate proved little. I feel that the debaters lost a great opportunity in failing to give accurate reports of cases in use over a period of years. My observations in comparing the effect on supporting structures with the conditions where other forms of removable work have been used are that the teeth remain firmer without irritation of gingival tissue and without traumatization of the tissues involved. As stated before, I have reached my conclusions as a result of my own cases. I have checked up cases as follows: Forty-five cases of three tooth involvement, supplying one tooth; fifty cases of four tooth involvement, supplying two teeth; twenty cases of five tooth involvement, supplying three teeth, and ten cases of six (or more) tooth involvement. Of this number, practically all are giving very satisfactory service; the only exception being that a few cases show just a little erosion on the clasped teeth owing to the patient's failure to keep the teeth and clasps perfectly clean, and, to a great degree, I hold myself responsible for their failures, as I have not succeeded in making them see the importance of carrying out my instruc-

tions, although we will always have the occasional careless patient to deal with. I have found that, more commonly, this erosion occurs below the clasped contact point or near the gingivae.

CONCLUSION

We see so many mouths wrecked through premature loss or necessary loss through extensive periodontic involvement, and we must recognize that to allow these cases to go unrestored spells ultimate failure for us in our work, regardless of how thoroughly our operations are performed.

Recently, I heard a specialist defined as "one who knows more and more about less and less." Shall this be true of the dentist, many of whom are classed as specialists? From my observations, I should say that there are few of us who limit our practice strictly to one field. Since it is our aim to prevent disease, it should most certainly behoove us to "know more and more about more and more." The majority of those who constitute the clienteles of the thinking and more progressive dentists are of the more conservative class, who are unwilling to sacrifice teeth, a tooth or any part thereof, and I believe that in the one-piece cast type, we have a most conservative and satisfactory type when properly designed and made and one that can be comfortably adjusted to the teeth and does not necessitate the adjustment of the teeth to the appliance as claimed by some.

Suppose we had a space to be supplied, having perfect or well-filled abutment teeth, and by a minimum of grinding preparation and with one impression and bite, we could have that space satisfactorily filled, would we not rather choose that method than a method requiring much more grinding preparation and a series of impressions and fittings, and be subjected to all the disagreeable steps that the latter method necessitates? Only what we would choose for ourselves should be advised for our patients.

The principles involved in the making of removable appliances whether they are one-piece cast or assembled cases are quite the same as in the making of fixed appliances, and the more closely our removable appliances approach the fixed bridges in effect, the more successful they will be, if they are in good occlusal relationship and balance. It is most important to have frequent check-ups on any and all bridges in order to maintain occlusal harmony. The failures in one-piece cast work are largely due to failure to carry out a definite and correct technic and are not to be blamed on the method.

Theoretical opinions count for little; proven opinions bring out facts, and I trust that my illustrations have proved the points I have tried to bring out. Finally, I would add that if we will train ourselves to work with a master hand, any method that is fundamentally sound can be used with success.

OCCLUSION*

By JOHN OPPIE McCALL, A.B., D.D.S., F.A.A.P., F.A.C.D., New York City

SO much has been said and written about occlusion during the past ten years that it would seem impossible to add a new thought on this subject, or even to present it from a new angle. It nevertheless appears that the subject is not outworn, if only because of the fact that theories proposed by presumptive leaders in the profession about occlusion, and more particularly about traumatic occlusion, are not universally accepted.

The last few years have seen a remarkable unification and harmonizing of the ideas regarding occlusion as held by periodontists, prosthodontists and orthodontists. It seems to be generally accepted that these three groups hold essentially the same ideals regarding occlusion. Stated in another way, normal occlusion means very much the same thing to each of these three groups, and each of the three strives, by whatever resources it can command, to achieve a basic ideal in occlusal relations. When we seek the reasons back of this unifying process, we find that the prosthodontist has been seeking an arrangement of artificial teeth which would contribute toward the stabilization of dentures. The orthodontist and the periodontist have also had the idea of stability as one of the objects to be achieved by their operations. They have also, more definitely than the prosthodontist, had the ideal of health as a goal.

When we consider occlusion from the health standpoint, we find general agreement as regards the prophylactic influence against caries, of normally arranged teeth. On the other hand, the question of the influence of occlusion, and more particularly traumatic occlusion, on the health of the periodontal tissues is not agreed on by all. It is not my purpose to make this paper controversial, principally for the reason that all the arguments and all the proofs available at the present date have apparently been presented. Until further histopathologic research, based on both clinical and experimental work, has been carried through, we must admit that the theory of traumatic occlusion as a causative agent in periodontal disease is incompletely proven. Such evidence as we have is satisfactory to most dentists who have carefully examined and tested it.

I stand by my published statements on this theory, and shall accordingly devote myself here to the presentation of such thoughts on the management of occlusion as may seem helpful, first setting forth some of the more prominent requirements as to the arrangement of occluding surfaces from the health standpoint.

First, although not most important, is the matter of protrusive balance. Without making a dogmatic assertion that protrusive balance is essential for the maintenance of health, I claim that it is essential for complete restoration of health in most cases of periodontal

*Read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

disease involving the anterior teeth. By protrusive balance, we mean that relationship whereby there occurs, at the moment of edge-to-edge contact of the incisors, a simultaneous contact in the posterior part of the mouth. This is usually brought about through the harmonious interrelationship of the condyle path, the curve of Spee and the overbite of the anterior teeth. We may put aside the possibility that injury to the anterior teeth occurs through excessive effort in the incising of resistant food, as has been claimed by some, for the nerves of the periodontal structures will warn the individual against this kind of overload. The harm which is done during the incising function occurs after the food has been incised, and when the teeth themselves come into contact. At this instant, if protrusive balance is lacking, the entire force which is being exerted by the muscles of mastication is expended on the periodontal structures of the anterior teeth. If the molars or bicuspids make a simultaneous contact at this time, the load is distributed between these teeth and the incisors.

This situation is similar in its general effect to the arrangement provided in the making of the more delicate cutting pliers. These tools have an edge-to-edge contact of their blades, and, for the avoidance of injury to these blades, a stop is usually provided which prevents movement beyond the point at which actual contact is made. I need only add that this arrangement, as also the provision for balanced protrusion in the mouth, does not interfere with the performance of the normal function of either type of apparatus. It may be urged that the incisors are intended to be used with a shearing action, and that a stop is therefore unnecessary. Theoretically, this is true, but examination of the facets worn on the incisal edges of anterior teeth will indicate that fully 90 per cent of the population use the incisors in the manner of cutting pliers, rather than like shears.

Balanced protrusive contact also implies a means for guarding against undue stress on the anterior teeth when the jaw begins to move forward to the incising position, or when it undergoes the slight protrusion which usually accompanies the lateral movements involved in the mastication of food by the posterior teeth. Protection against such stress must be achieved by such management of the labial surfaces of the lower incisors and lingual surfaces of the upper incisors as will permit these gliding movements without premature engagement of the anterior teeth. We are here dealing with relationships between the so-called inclined planes of the posterior teeth and the corresponding surfaces of the anterior teeth. This may be exemplified by contrasting different possible arrangements of the anterior teeth with a normal cusp inclination of the posterior teeth. If the upper incisors have a more or less perpendicular position in the maxilla, their lingual surfaces will be nearly at right angles to the direction in which the mandible is guided by the posterior cusps. In the average arch, such movement will immediately bring about an engagement of the upper and lower incisors, and further movement is accomplished only by a definite change in the direction of the mandibular movement, enforced by the incisal guidance. This results in transferring the occlusal load from the posterior teeth to the anterior.

Compare this with the situation in which the upper incisors are placed at an angle which provides for an oblique inclination of their lingual surfaces. Under these circumstances, the average mandibular movement is not altered in

its direction by the incisal guidance, and the incisors are therefore not subjected to undue stress.

When we are dealing with teeth which, for one reason or another, cannot have their position or inclination altered, we must provide the necessary elements of protrusive balance by alteration of the tooth surface. This requires grinding of the anterior teeth in the average case, but may occasionally necessitate remodeling the posterior teeth by restorations, or even opening the bite.

A thorough study of the principles of occlusion as they are being developed by the prosthodontists of today will be most helpful to those who desire to take up this phase of periodontal treatment. This group has of necessity developed to a high degree the knowledge of the gliding contact relationships of the teeth as they relate to the movements of the mandible. Like the periodontist, the prosthodontist deals with varying conditions of the supporting structures on which his work is built. He must devise means for reducing stress on tissues which have a limited power of endurance, and he usually accomplishes this by modification of cusp height and inclination. The periodontist, in his dealings with supporting structures, must do the same.

In the normal functioning of the posterior teeth, the principal movement of the mandible is from side to side, this action being intended for the accomplishment of food trituration. In lateral movement, the downward inclination of the condyle path has less guiding influence than in protrusive movement. The result is that the mandible tends to move almost in a horizontal plane. This horizontal movement is altered by the inclination of the cusps of the upper and lower posterior teeth. The greater the height of the cusps and the sharper the angle by which their slopes diverge from the horizontal, the more nearly the lateral movement tends to become a vertical one. The burden of this alteration of the direction of mandibular movement is borne by the periodontal structures of these posterior teeth. Let me say at once that this burden is a physiologic one; for it is a fact that nature forms teeth with cusps and also provides for these lateral movements, with their direction influenced by cusp guidance. We cannot therefore argue for obliteration of the cusps of the posterior teeth, when the mouth is in a state of health. Neither can we specify any given angle of cusp inclination as normal, with the implication that angles greater than this will cause occlusal trauma.

In this connection, it is interesting to note that the primates are the only animals having pronounced cusp formation of the posterior teeth, and having, at the same time, provision for marked lateral mandibular movement. This suggests the necessity of making careful provision for the protection of the supporting tissues of the posterior teeth, if, for any reason, they are deficient in the strength needed to resist the stresses induced in such a system. It should also be noted that the action of these cusps against one another brings into play the mechanical principle of the wedge, one of the most powerful forces known. The periodontal tissues of modern man seldom exhibit the power for supporting indefinitely the amount of stress which is imposed by cusps of decided inclination.

It seems entirely logical, then, that when disease has entered the picture, and the periodontal tissues have been weakened thereby, we should study cusp inclination in order to ascertain whether modification is necessary for the re-

storation of health. It may be argued that people have cusps of decided inclination and yet preserve the health of the periodontal tissues for many years. Accordingly, when these individuals begin to have disease, it would seem that this must be due to some other agency.

The true explanation of this phenomenon appears to be that the resisting powers of these tissues, which are high in youth, diminish after a point which may be termed maturity. The age at which this occurs may vary with different individuals, but careful observation would seem to place it at about 30 years. Primitive man, with all his vaunted physical perfection, was not exempt from this rule. In his case, protection against periodontal disease was accomplished through the medium of natural wear, which progressively modified cusp inclinations, thus providing for a reduction of lateral stress. Modern man does not accomplish this wear, except occasionally. Too often, we see individuals of 40 years or more whose cusps are virtually as steep in inclination as when the teeth were first erupted. These people almost invariably develop either periodontal disease or disease involving the pulp circulation.

The extent to which cusps must be flattened in the treatment of disease will vary with the age and susceptibility of the patient, and the amount of destruction of alveolar bone which has already occurred. No arbitrary angle can be laid down which fits all cases. This angle must be determined, in the last analysis, by the response which the tissues give to the relief. Modification of the cusp angle is not complete until the teeth involved have become entirely firm in their sockets. And it may be proper to interpolate here that no apoxesis should be undertaken, until the teeth have given evidence, by their increased firmness, that their occlusion is no longer traumatic. Partial improvement, which always follows correct apoxesis, is liable to be misleading, if instituted at an earlier stage of the treatment.

CONCLUSION

The difficulties which have been encountered by many dentists in their efforts to apply the theory of cusp modifications are seldom to be traced to excessive grinding. I would not belittle this serious possibility; but it has been my observation that dentists, in their efforts not to overdo, fall short of accomplishment, and, for this reason, fail to secure improvement of the disease. Also, if the slightest disbalance remains after grinding has been discontinued, the patient is acutely aware of this condition and may be made very uncomfortable thereby. When grinding nears completion, the dentist should rely largely on the sensations of the patient as a guide to the necessary refinement of this procedure. This frequently involves a protracted and difficult search for offending points of unbalanced contact, which must be reduced to secure the desired result. Personal experience extending over a period of fifteen years has proved that modification of occluding surfaces in accordance with the principles herein stated is not only a necessary part of successful periodontic treatment but also a source of comfort and satisfaction to the patient.

OPERATIVE PROCEDURE IN PERIODONTIA*

By JULIAN SMITH, D.D.S., Dallas, Texas

IN the symposium on "Operative Procedures in Periodontia," we have heard facts and theories on various phases of periodontic treatment, all excellent in their individual methods of presentation, and almost universal in their ideas of treatment.

The papers on operative procedure follow pretty well the same lines, and I could wish that we had included the subject of radical methods as one phase of the subject, so that we might make comparison between the conservative and radical surgical methods in this summary.

Dr. Hutchinson presents in a clarified manner the recognized steps in conservative operative procedure. Dr. Towner touches lightly on radical treatment, but believes in confining his radical work to special conditions. Dr. McCall presents the correction of traumatic occlusion in a concise and practical manner, from a periodontist's standpoint; while Dr. Maves handles the same subject from the standpoint of the research work of the prosthodontist.

I shall endeavor to select the most important ideas in each of these presentations and call attention to their importance in relationship to each other.

That a case history is an essential item in diagnosis is accepted as one of the first steps in outlining the course of treatment in each individual case. Without such information, we are groping in the dark, in regard to systemic influences and, as Dr. Towner expresses it: "It presents an important problem in the treatment of diseases of investing tissues and means more for, or against, immunity than all else in certain cases." To neglect this important phase of diagnosis is to isolate an influence that might prove the dividing line between success and failure.

As Dr. Hutchinson says: "Cases cannot be treated by stereotyped methods. The exact procedure in each individual case must be determined and modified to suit conditions." So, by a consensus of opinion, we must agree that a consideration of systemic conditions is the first important point in diagnosis.

The next obstacle to be overcome should be the study of the occlusal relationship between the jaws and correction of excessive individual stress between the opposing teeth.

Clinical evidence convinces us that there is a pathologic change in the periodontium wherever there is traumatism. A destructive process is inaugurated both in the alveolar process and in the pericementum, changing the physiologic characteristics of each structure. This process has been clearly described by Harold Keith Box in his "Studies in Periodontal Pathology" under the title of "Rarefying Pericementitis Fibrosa."

Our research work has established many important facts in etiology, but

*Correlation of papers by Drs. Hutchinson, Towner, Maves, Schott and McCall, read before the American Academy of Periodontology, Detroit, Mich., Oct. 21, 1927.

there is still a great field for development in periodontal pathology before we can, with any degree of certainty, predict our results.

The only feature in treatment that has a definite standing is the surgery of the root surface. Herein lies the basis of all successful treatment, as every pathologic condition is subservient to the infectious or noninfectious influence of this area. The root surface is the holding medium for bacteria, the point from which infection is distributed, and is also the seat of calcific deposits, salivary or serumnal, continuing a local mechanical and bacterial irritation in the adjacent tissues.

The essayists agree that the skill required to curet adequately the surface of a root, to remove all these destructive influences, can be acquired only by long and diligent individual effort. The general principles can be taught, but that delicate sense of touch which enables one to see, with the end of an instrument, just what character of substance it is in contact with, can be obtained only by years of constant practice.

Dr. Towner endeavors to teach us just how the feel of the instrument conveys this information, and a close study of his ideas will materially assist the inexperienced operator; but efficiency is acquired only by diligent study of the contact between blade and root. Dr. Hutchinson sums up the subject in these words: "Each operator must develop his own technic, but it requires years of patient work to bring it to a point approximating perfection."

The essayists are practically in accord as regards the principles and practice of periodontia; but while Dr. Towner does not altogether condemn the radical operations, Dr. Hutchinson says: "The ruthless destruction and removal of large areas of healthy soft and hard tissues is unnecessary, unjustified and pernicious."

Dr. Towner says: "Personal experience and clinical observation emphasize the fact that regeneration of alveolar structure seldom, if ever, follows alveolectomy, and this operation is done at the expense of reattachment and possible regeneration, which must be depended on for desirable results."

The correction of occlusion is the next phase of the treatment to be considered. Dr. McCall says: "The unification of ideas regarding occlusion, by periodontists, orthodontists and prosthodontists, means much the same thing to these three groups, each group striving to the same end, viz., to achieve a basic ideal in occlusal relations, with the ultimate aim to establish stability." To obtain this result, each group must vary its methods according to the existing conditions, and the possibilities in arranging or rearranging occluding surfaces, into an harmonious relationship which we call normal occlusion.

The periodontists do this largely by grinding, the orthodontists by traction and the prosthodontists by adapting curves and cusps of artificial teeth to such harmony of movement that resistance in proper places is established and stability obtained.

Dr. McCall has so clearly described the principles of correcting occlusal stress and obtaining protrusive balance by grinding that further comment is unnecessary. The happy comparison that he has chosen, of the action of the delicate cutting pliers, to the protrusive balance in the incisal region of the arch, with control of excessive force, demonstrates this condition so clearly that it cannot be misunderstood. Of course, the operation of grinding teeth is limited to those cases of moderate overbite, on account of sensitiveness of teeth in

the deeper structures, so that excessive overbite must be cared for by raising the occlusion or opening the bite.

Dr. Maves minutely describes the process of establishing normal occlusion after the desired amount of opening has been determined. The main idea in this work is to establish balance where balance has been lost.

All masticating movements start and finish in central occlusion; consequently, this must be the starting point in all restorative work, whether bridgework, partial restorations or full dentures. Open bite cases require an additional starting point, viz., a consideration of the amount of opening necessary. After reading Dr. Maves' article, the foremost thought is that restoration and opening the bite, to be much of an aid to us, must be in the hands of purely scientific operators, and that we, as periodontists, should so educate ourselves in balanced occlusion that we can be the final judge in deciding when the desired result has been obtained.

There are many important features in these essays that have not been touched on, but the essayists have brought out each idea so vividly that it would only be reiteration to go into them particularly.

Dr. Schott says that the periodontists "have contributed much toward raising the standards of dental restorations." The fact is that the periodontist is so dependent on other specialists for his success that, unless he is granted the privilege of supervising and criticizing each phase of restorative work, his responsibility is reduced to a minimum and his individual efforts often result in failure.

Granting that the periodontist is the real mouth internist, what a responsibility lies in his final judgment as to occlusal balance in natural teeth; the proper type of restorative work to suit each condition; correcting occlusion by grinding, opening the bite or orthodontic methods; consideration of the type of restoration indicated, according to the relative positions of anchor teeth and the strength and depth of the supporting structure, and the prognosis of the case as to these structures. These are just a few of the things on which he is called to pass judgment, and even with the thorough cooperation of his fellow workers, the responsibility of success or failure must be his alone.

Dr. Schott's paper is largely an indorsement of the one piece cast appliance, and his arguments in its favor are good. Of course, he is making his plea on the basis that every one who makes this type of restorative will produce a perfect-fitting, nonirritating appliance, but when we consider how little deviation in applied force is necessary to start destructive processes in the periodontium, I am inclined to advise against the occlusal rest and clasp, wherever periodontal disease has destroyed a material part of the supporting structure. The fixed bridge, in small restorations, acts as a splint, or support, for weakened teeth, tends to restore, rather than destroy, integrity in the periodontium, and is, in most cases of so-called pyorrheic conditions, a much more desirable type of restoration.

BASIC NECESSITY OF AN ACCURATE IMPRESSION TECHNIC IN THE CONSTRUCTION OF CAST GOLD PARTIAL DENTURES*

By. M. B. RUDD, D.D.S., Richmond, Va.

PAPERS on technic are generally tedious and uninteresting. The description of models, casts, clasps and similar items grows monotonous. I shall give some reasons why I prefer cast gold restorations, briefly describe the technic of construction and present illustrations which I trust will clarify the description.

Gold alloys and rubber are the two principal materials used in the construction of partial dentures. Unless there were good reasons for the use of gold, the cheapness and ease of manipulation of rubber would make it preferable. Gold is expensive, and the time consumed in construction makes dentures of this material cost the patient two or three times as much. Rubber absorbs the fluids of the mouth, does not register sensation as to the heat and cold of the substances taken into the mouth, is harder to keep clean, is more difficult to stabilize, does not maintain a high polish, is more bulky and necessitates the covering of more tissue surface. It is not so pleasing to the wearer; stressbreakers cannot always be attached without creating food spaces and adding to the thickness; it gathers and cultures bacteria, and, in some mouths, tissue health is hard to maintain. Rubber breaks easily. The teeth on rubber bases are short and have not the feeling of natural teeth to the tongue. The general esthetics are not so good as in gold dentures. That they may be cheaply made and simply rebased are the only redeeming qualities of partial dentures made with rubber. Vulcanite, however, has an important place in every dental practice. The patients who have been most neglectful are, as a rule, people of moderate means, who cannot pay for gold restorations. The main reasons why so many more dentures are made of rubber are: the expense of gold, the difficulty of construction and the likelihood of a misfit when completed.

I have no unusual ability; nor is there sufficient originality in the technic that I shall describe to permit me to have any mistaken idea as to my being an inventor. Practically everything in this method of construction has been developed through the coordination of the ideas of others and of old principles of dentistry. My only reason for writing this paper is that I may pass on to others a thing that has given me a great relief from dread and worry. Prior to the adoption of this way of making partial dentures, I labored in an attempt to make these restorations satisfactory. Cast gold or swaged gold partial dentures were the bane of my existence. By the previous methods attempted in gold construction, both the

*Read before the Section on Partial Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 27, 1927.

patient and I were worn out from the taking of many impressions. When the case was completed, I feared what quite frequently happened; the denture would be hard to place or would not stay in place. If a denture were made having several retainers and it did not go to place, it was an impossibility to tell which clasp or retainer was responsible for the trouble. I would guess and the chances were three to one that I was wrong. To build cast partial dentures and guess at any part in the construction

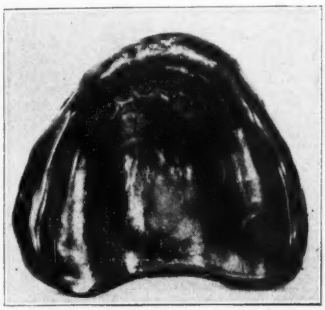


Fig. 1.—Preliminary impression in compound from which a tray is designed.

Fig. 2.—Trimmed tray.

or the fitting is costly and often embarrassing. I hope to show how this may be prevented.

By far the happiest part of my practice now is the extensive cast partial denture work. When the patient comes to the chair, I have no fears for the first "try in," which is the time when both patient and operator are most critical. Both are pleased beyond expression if the denture slips easily to place and remains firmly in position.

The secret of success in the making of dental restorations, more especially dentures, full and partial, is in the impression. Without a perfect impression, we cannot hope for a brilliant result; it matters not how beautifully we carry out each succeeding part of any method. We must, then, secure an accurate impression and make an indestructible cast which will duplicate the mouth. If we have a duplicate of the mouth in a strong cast, what can be the necessity for taking impressions of parts of the denture in the mouth? Why not make our fittings on this duplicate and take as many impressions as needed; in fact, treat the duplicate as we would the original. There is certainly far less danger of movement of these parts when the troublesome features of mouth impressions are eliminated.

It is obvious from the foregoing statement that the technic to be discussed deals with construction by an indirect method.

By working on stone and amalgam casts, much is learned as to the contraction of gold alloys, and the necessity for short castings becomes apparent. With dentures made by the direct method, a considerable amount of contraction is not noticeable since the teeth move when the denture is placed on them and we cannot see in the mouth the inaccuracies that are apparent on the cast. The fact that we can check up on the contraction be-

fore placing the denture in the mouth justifies the time consumed in making short castings and connecting them. There are many other advantages that might be enumerated, but the thoughtful technician will recognize them and to describe them all would unduly lengthen this paper.

I will take up the technic of construction, beginning with the taking of the impression. The impression technic has been described in a previous paper,[1] but to carry through the construction of a partial denture without showing how we get an accurate impression would mean to leave out one of the most essential steps in the process. Some repetition of so important a subject cannot be harmful.

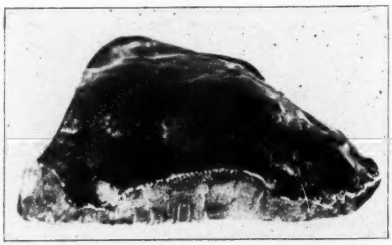


Fig. 3.—Tray after the buccal part of the compound is cut off on a line through the sulcus of the bicuspid to the point of the greatest buccolingual convexity of the molar.

Just a few words as to some of the methods by which partial impressions are taken: The push in and pull out mass impression, with both plaster and compound is inaccurate, and therefore unreliable for partial denture work. The split plaster impression is subject to criticisms such as the difficulty of removing it from the mouth, finding all the parts, the reassembling of them and the condensing of the plaster against the teeth due to the force necessary to remove it. It is an extremely disagreeable experience for the patient to have a mass of plaster in the mouth. The sectional modeling compound impression has not proved reliable in my hands and I doubt that any one can be sure of it. Split trays, half trays and swaged trays are adaptable for short sections, but not for the whole mandible or maxilla. The all plaster sectional impression is accurate; but it is hard to control the plaster, and, for that reason, it is an objectionable impression.

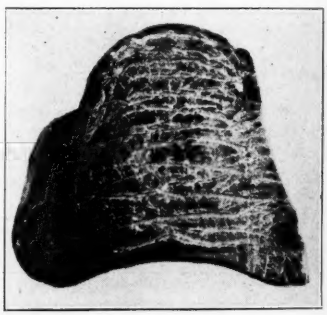


Fig. 4.—Tray scarified.

The construction to be shown will carry through the making of a partial denture on the maxillary case which has six anterior teeth, the two first bicuspids and the right third molar. I will show the impression technic referred to for this case, also other steps in construction.

IMPRESSION

Select a tray to fit the mouth and oil it. Heat about three cakes of modeling compound and take an impression. (Fig. 1.) There is no need to cover the labial and buccal surfaces of the teeth fully. Do not force the inner surface of the tray in contact with the incisal and occlusal surfaces of the teeth. Chill the

1. Rudd, M. B.: Sectional Impression Technic, J. A. D. A., 14:2036 (Nov.) 1927.

compound, remove it from the metal tray and trim a compound tray in the following manner. (Fig. 2.) (On the proper shaping of this tray depends the success of the impression, so I will go into some detailed description of how this is done.)

Cut away the compound labially, flush with the labio-incisal margins of the six anterior teeth. Continue its removal bucally through the sulci of the biscuspids and posteriorly to the crest of the ridges on the left and the right. Perpendicularly (Fig. 3) cut away the compound along the crest of the ridge and through the center of the third molar on the right. On the left, prepare the saddle portion of the tray in the same manner as if the tray were being prepared for a full impression in which we use a compound tray to carry the plaster. The peripheral border on this side is cut shorter than we wish the finished impression to be. Thin the modeling compound over the ridge and in the vault and cut it off at the junction of the hard and soft palates. Try this in the mouth and see that there are no obstructions to prevent its easy removal. When this fitting, and any additional trimming necessary is completed, roughen the interior (Fig. 4) of the tray, including the imprints made by the teeth. This insures the adhering of the plaster to the compound tray.

It has already been stated that the inner surface of the metal tray should not come in contact with the occlusal and incisal surfaces of the teeth. The compound tray is left at least a sixteenth inch thick over the teeth in those areas where buccal and labial sections of plaster are to be made. When these sections are placed against this compound and allowed to flow on the top of the flattened tray, a mortise joint is formed which leaves no question as to where these sections belong when assembling the impression. If the knife is sharp, this tray may be trimmed in twelve minutes, including the roughening of the interior.

A sectional plaster impression will now be taken. Mix the plaster, dip the compound tray into it (Fig. 5), add enough to insure a surplus, and place it in the mouth. As soon as the plaster sets sufficiently to break (Fig. 6), clear

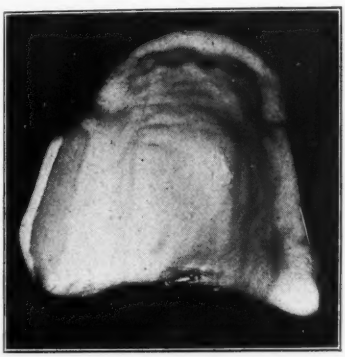


Fig. 5.—Tray properly loaded with plaster preparatory to placing it in the mouth.

Fig. 6.—Palatal section of the impression in place with all surplus plaster removed.

it away buccally and labially, especially distally from the bicuspid on the left. Clean off all small particles of plaster and oil the teeth and compound tray with commercial cocoa butter flavored with wintergreen. Mix small quantities of plaster and make three buccal and labial sections. (Fig. 7.) Attempt but one section with each mixture of plaster. Place a section on the left and one on the right beveling the anterior ends of each distally; then oil these sections and place the third section between them. The plaster of each section should be carried high up under the lip or cheek and, with slight pressure, should be forced downward and on the top of the compound tray.

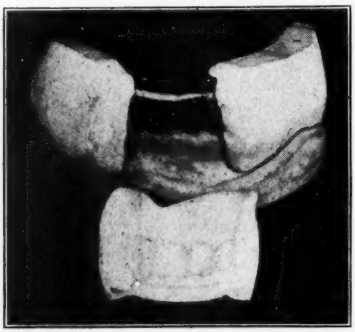


Fig. 7.—Four sections completed.

The removal of these sections is an easy matter as there will be nothing to hold them. The palatal section should be chilled and water poured around the periphery. The compound tray is then grasped on the left with thumb and finger, and slight force is applied, the tray being moved up and down until water seeps under it. It will then come out with all the plaster adhering to it.

The assembling of these sections (Fig. 8) will be quite simple, as one fits into the other. They should be fastened together with sticky wax. The time usually required to take an impression of this kind is one hour (less, with experience in the technic).

The impression is now boxed and prepared for the making of the cast. When sandarac is used in varnishing, do not allow any of it to enter the impressions of the teeth. Thin shellac is absorbed by the plaster and may be used for the first coating. This may enter the impressions of the teeth.

THE CAST

The cast must be made strong so as to withstand a good deal of force. First, pack the teeth with copper amalgam. (Fig. 9.) Do not use silver amalgam for casts. While the copper amalgam is soft, force small finishing nails into each tooth. The head end of the nail will project above the necks of the teeth about half an inch. The amalgam is then repacked around these nails and left rough. It takes ten hours to set. Then the stone is vibrated to place and allowed to harden. We now have a duplicate of the mouth in a cast (Fig. 10) which will withstand the force necessary in the fitting of the castings. The teeth will not break away from the stone nor, with

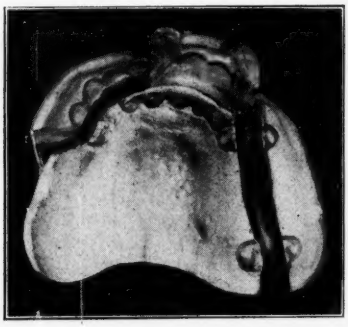


Fig. 8.—Sections being assembled.

copper amalgam, will the mercury rub off on the clasps.

BITE

Too little care, as a rule, is taken in securing a bite. The objective to be attained is to establish the proper occlusal relation with the natural teeth. This may seem simple, but oftener than would be supposed, we find that we have established an incorrect relation. For example, we place a piece of wax on one side of the mouth and ask the patient to bite into it. The closure will be toward that side and the teeth on the opposite side will not be properly occluded. This frequently happens in getting our bites for bridges and it accounts for much grinding. When we are securing a bite using wax and have not an opportunity to observe the occlusion of any of the teeth, we will find the same difficulties encountered by the full denture prosthetist. We will have protrusion or a lateral bite, or both combined. The tendency when meeting with resistance is always to reach out with the lower jaw and engage the substance, at the same time swinging the jaw to the side most used for mastication. Even if we have obtained in wax the natural relation of the mandible to the maxilla and an exact copy of the occluding teeth, there are other objectionable features. We guess when we seat it on the cast and can scarcely ever know that it has not been bent or warped. In addition, amalgam cannot be packed into it. I prefer the plaster bite because the patient meets with no resistance in biting into the soft plaster, so registers a correct occlusion. Furthermore, amalgam may be packed into it.

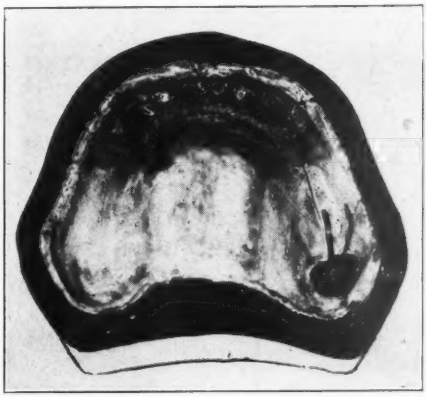


Fig. 9.—Amalgam packed into the teeth with small nails inserted into it.

To obtain a plaster bite, develop a bite-plate on the cast and place tin foil on it (Fig. 11) after verifying it in the mouth. Let this foil be slightly wider than the wax bite-plate and the occlusal surfaces of the teeth. Fasten it to the bite-plate by forcing a hot spatula through the foil into the wax. Again, place it in the mouth and let the patient bite on the tin foil, leaving the indentations of the teeth. Turn up the edges of the foil 2 or 3 mm., forming a shallow tray. Mix the plaster soft and place it

in this shallow tray. If too much plaster is not used, the occlusal surfaces only (Fig. 12) of the teeth are taken. Some object to the time consumed in securing this bite (about twenty minutes), but it will save an hour of spot grinding and possibly making over. Pack this bite with quick setting amalgam and articulate. We do not only secure greater accuracy in obtaining normal occlusion by the use of the plaster bite, but, in addition, the metal cusps of the amalgam teeth do not fracture in building our supplied teeth against them. With a stone and amalgam cast and amalgam teeth of the opposite jaw (Fig. 13) in their proper relation and securely fastened on the articulator, we are ready to proceed with the designing.

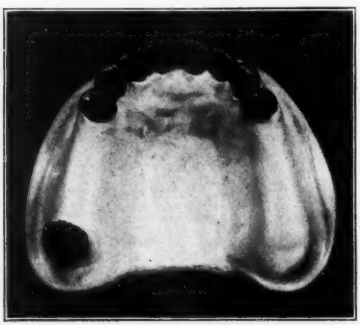


Fig. 10.—Stone and amalgam cast.

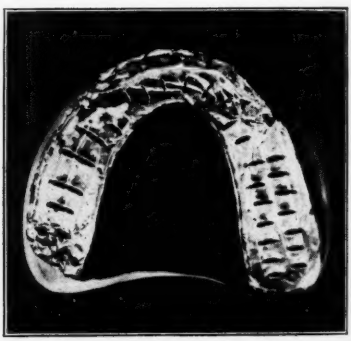


Fig. 11.—Bite tray made of tin foil.

DESIGN

The designing is roughly planned before beginning the case and is worked out finally on the cast where all angles and contours are clearly visible. Some general observations will be mentioned which are applicable to any cast partial denture. Secure stability by a judicious use of clasps or other retainers. Use stressbreakers whenever possible to avoid undue strain on the abutment teeth. The saddles should be wide if the ridges are to carry the load in mastication. In unilateral cases in which there are no teeth at the posterior end of the saddle, the saddle should be supported by a palatal strap or lingual bar attached to a direct retainer on the opposite side of the jaw. Posterior saddle cases with no attachment across the mouth will not function properly without damage to their supports. The size and strength of all retainers is estimated according to the opinion formed as to whether they will be subjected to a greater or less degree of force.

The saddle part of the denture should never extend into the interdental spaces. These spears (Fig. 14) that are so often seen are not necessary for retention and invariably cause irritation. The denture should not rest on the crest of the gingiva, as this retards the circulation, and atrophy of the supporting tissues of the teeth follows. Stressbreakers may be a part of the design of any case in which there are six natural teeth contiguous to each other, but when there is a smaller number, the denture will be better constructed to depend entirely on the mucosa for support. If the denture carries two

or more posterior teeth and there are no natural teeth distally from them, stress-breakers should be used.

CAST CLASPS

Cast clasps should be made as narrow as possible. Yet they must maintain their grip on the teeth. They should be formed around the teeth at the highest point of convexity and should be sufficiently thin to maintain flexibility. Occlusal rests should be added only when teeth are at both ends of the saddle, unless stress breakers are used. To place occlusal rests on clasps where we are

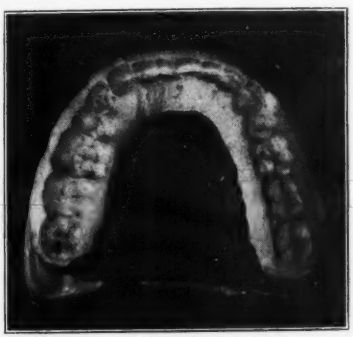


Fig. 12.—Plaster bite.

attaching the denture to an anterior tooth and there are no posterior teeth causes the denture to ride on the tooth, and the saddle only rests on the posterior part of the ridge, unless stressbreakers are a part of the design. Without stressbreakers, the overload and leverage on the tooth so attached soon cause its exfoliation. Cast clasps are much abused by some, but they will cause no greater loss of tooth structure from decay than any other clasp if properly designed and polished on the inner surface. Whenever stressbreakers are used, the clasps must be formed with occlusal rests. The design of the clasp is dependent on the length of the tooth, the location of the convexity and the function that it is expected to perform.

WAXING AND OCCLUDING

Before placing the wax on the cast, treat it so that the wax will not adhere to it. This is done by painting it with cocoa butter dissolved in gasoline. There is no necessity to be very exact as to the proportions. A mixture of 1 ounce of cocoa butter to 4 or 5 ounces of gasoline will be sufficiently accurate. The gasoline quickly evaporates, yet the cast will be left oily enough to prevent the wax

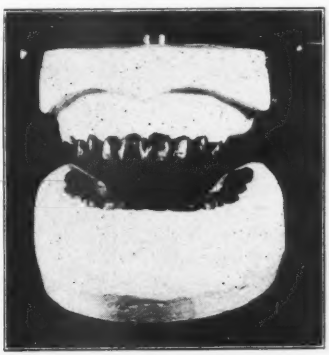


Fig. 13.—Cast articulated.

from sticking. The choice of wax and teeth is left to the individual. The wax should be carefully adapted to the cast and more area covered than is desired for the finished denture, to prevent movement of the wax while the teeth are being set up. After the denture has been completely waxed and the teeth have been occluded, the surplus may be cut away to the size of the design desired.

REMOVAL OF WAXED AND OCCLUDED DENTURE FROM THE CAST

The question as to how to remove the waxed denture (Fig. 15) from the cast

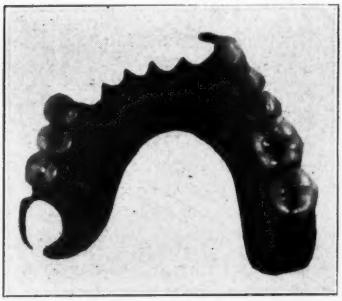


Fig. 14.—A partial denture showing interdental spears (undesirable).

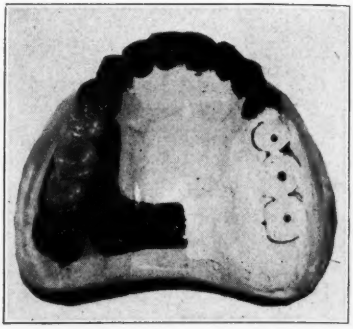


Fig. 16.—Denture with the saddle on the left side coated with investment compound.

and at the same time preserve the accuracy obtained up to this point has been confusing to some. On the left, at this stage in designing, there is no clasp around the bicuspid. The palatal strap connects the opposite side of the denture. This strap is cut in a way to give the greatest soldering area for strength where the castings are to be connected. Remove the teeth from the saddle on the left. Paint the whole saddle (Fig. 16) with an investment material, and after it has set, lift it off the cast. Painting the wax with an investment material before removing the saddle eliminates any possibility of warping it. This method of removal of parts only applies when no clasps are attached to the saddle. On the right the removal of the wax may be effected by taking a plaster sectional impression. (Fig. 17.) The teeth, wax and cast should be coated with soap and water to prevent the plaster from sticking, and any spaces the presence of which would prevent the easy removal of these sections should be filled with model clay. Do not let the model clay overlap any of the wax framework. Remove this portion of the denture; place it in one-half of the plaster section; bring the other half into position, and fasten them

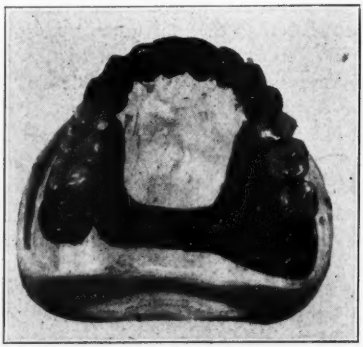


Fig. 15.—Denture waxed and articulated.

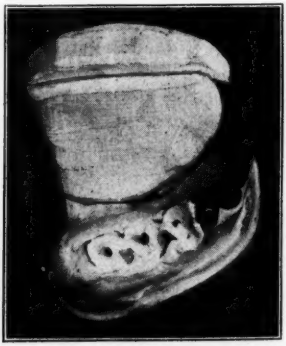


Fig. 17.—A sectional plaster impression of the right side of case.

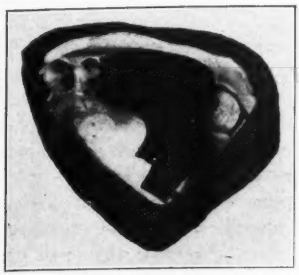


Fig. 18.—Impression assembled with the waxed part of the denture in it, boxed ready to pour.

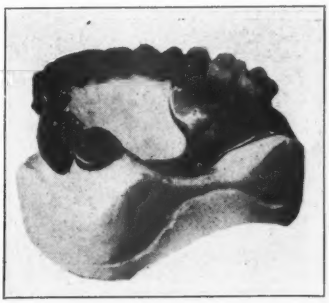


Fig. 20.—Clasp and stressbreaker bar formed in wax.

together. If there is distortion of the wax, a pledget of cotton dipped in warm water may be used to burnish the wax into the impression made by it in the plaster. Box (Fig. 18) and pour this impression with investment material. When the plaster sections are removed, take the teeth off, clean the wax and insert the sprue for casting. Observe that the teeth are not taken off until the casting model (Fig. 19) is made.

ASSEMBLING AND REMOVAL OF CASTINGS

When these parts of the denture are cast, they are first roughly polished. The posts are dressed with a trephine bur to permit the teeth to slip easily to place. The teeth are fitted in the metal boxes and the necessary adjustments made. Now, place the castings on the cast with the teeth in position on the left and fasten the teeth with sticky wax. Prepare in wax (Fig. 20) the clasp and stressbreaker bar. This bar extends along the lingual border of the saddle at the junction of the saddle and the teeth. This wax bar is made to the shape of the metal box in which the teeth are placed. It extends to the region of the first or second molar. To remove this clasp and bar, take a sectional impression of this side. Remove this part of the denture and place it in the plaster impression, burnishing it into the indentations made in the plaster as shown in the plaster impression taken on the right. Make a

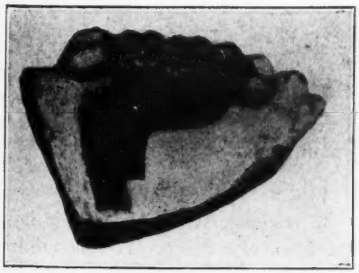


Fig. 19.—Casting model.

Fig. 21.—Section of the palatal impression of the castings.

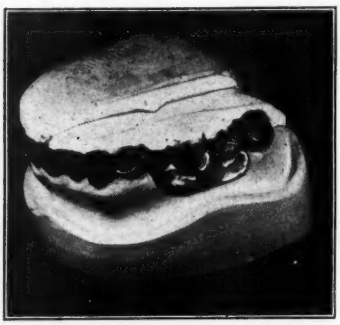


Fig. 22.—The two sections of the palatal impression of the castings.

casting model, invest in the usual way and cast. This having been done, the casting is cleaned, roughly polished and fitted in position and fastened at the distal end with sticky wax. We have the three castings fastened in two places with wax. Take a plaster impression of the palatal portion of the cast in two sections (Figs. 21-22), remove the castings and place them in it and make a soldering model (Fig. 23). Connect the three castings. When these connections are made, the denture is placed on the cast and the fit is verified. Should it be found that there is sufficient contraction to prevent the proper seating of the denture, the correction is made before polishing it. The parts of the denture having all been connected and the polishing completed, the teeth are put in position and the occlusion checked.

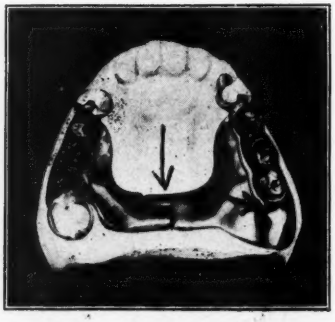


Fig. 23.—Soldering model, with castings in position. The pointers show the two places to be joined. Observe the way the palatal strap is cut.

I prefer to take the denture (Fig. 24) to the mouth and check up on the fit and the occlusion, cement the teeth on the saddles, then replace it on the articulator and work out the excursions. The amalgam teeth help in locating the high spots as they mark the teeth when the articulator is manipulated. Some spot

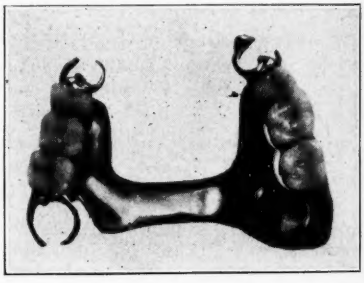


Fig. 24.—Completed denture.

grinding may be done. It is best to leave only the supplied teeth in contact for a day or two, and then grind to place in the mouth or replace on the articulator and finish the grinding so that all teeth, natural and supplied, are in contact. By having the patient make the protrusive and lateral excursions with the mandible, a functional occlusion may be secured. Without this, the comfort and health of the teeth and tissues will not be maintained.

CONCLUSION

The beginner with this technic must learn from experience. A few failures teach more than a whole series of lectures. The impression as shown in this

case is simple, but exacting of the operator. He must use care in the preparation of the tray. He must use a good impression plaster, mix it thoroughly and spatulate it well. He must not hurry to remove it from the mouth, but must let it get hard. If the saliva is removed from the mouth with the ejector or cotton rolls, the patient never complains. Much depends on the freshness of the plaster. Air slaked plaster should never be used. If at all doubtful of the quality of the plaster, test the setting of it by mixing a small quantity before beginning an impression. Too little consideration is generally given to the kind of impression plaster and the mixing of it.

Stabilization, another uncertainty met in dealing with partial dentures, may be definitely and positively proved before placing the denture in service. Should we find that an additional retainer, direct or indirect, is advisable, it can easily be added before the teeth are cemented.

I have not mentioned the selection, grinding and occluding of the teeth nor anything concerning the gages of the wax or the thickness of it, nor any casting technic. Every one doing this work has information along these lines that no doubt is sufficient for his needs. As to the kind of gold to be used, my preference is one alloyed with from 12 to 20 per cent platinum.

A most important benefit gained by having a stone and amalgam cast is that it may be filed away (Fig. 25) for use in case of accident. The breaking or bending of clasps and stressbreakers is not an unusual mishap in partial denture work. It is a simple matter to place the denture on the cast and repair the break. In this way, new clasps or stressbreakers may be made without additional impressions in the mouth. This I have done when the case had been worn for several years. Patients are advised that the casts are kept so that in case of

Fig. 25.—Casts labeled and stored so that a denture can be repaired, if broken, without the patient's presence.

accident the dentures may be repaired without the necessity of their coming to the office.

Methodist Publishing Building.

DISCUSSION

R. D. Thornton, Richmond, Va.: The technic described in Dr. Rudd's paper was introduced by him into the dental infirmary of the Medical College of Virginia some years ago. He is a most enthusiastic teacher of the method and readily convinces his students of its merits by practical demonstrations. Furthermore, practicing it in the dental infirmary relieves the instructors of many anxious moments in the insertion of partial dentures and assists greatly in establishing confidence on the part of the patient. There are a few main features which should be emphasized. If an accurate impression has been taken and casts have been carefully made, the time of the patient can be saved very materially and the number of impressions taken in the patient's mouth will be greatly reduced. On the other hand, if the operator feels doubtful as to the accuracy of his castings, he is still at liberty to return them to the patient's mouth just as frequently as he would do if pursuing some other method. Many operators seem to hesitate about spending the time necessary for an impression. As a matter of fact, time can be saved for the operator by this method and much more work can be delegated to the dental mechanic, which conserves the dentist's producing hours. By making the framework for a partial denture on rigid casts, inaccuracies are checked up as they may occur. Dr. Rudd has suggested that the movement of the teeth in their sockets often enables the dentist to get his restorations to place when they do not fit. Anyone who follows this technic for some time will be convinced of the necessity for making short castings and soldering these together to avoid the need for depending on individual tooth movement. Dentures made on model stone casts with metallic teeth must be accurate or they cannot be carried to place. The movement of natural teeth in their sockets to permit artificial appliances to be seated should be carefully considered by every prosthodonist. The orthodontist feels that he gets his best results in tooth movement by exerting a very slight pressure over an extended period of time. He realizes that very delicate appliances may exert sufficient tension to cause any tooth in the arch readily to change its position. He is dealing with young patients whose investing dental tissues are not likely to be so dense as those of most patients who require partial denture restorations. It would seem, therefore, that the insertion of partial dentures which require much movement of the natural teeth when the appliance is being seated may readily set up lesions in the supporting structures of the teeth and result in their early loss or in producing conditions which may be contributing factors in undermining the patient's general health. Dr. Rudd has made some very pertinent remarks in his paragraph on design. "Secure stability by a judicious use of clasps or other retainers" is timely advice. There seems to be a marked tendency in some sections of the country to use clasps for every type of case and to design and place them with little consideration for the function they are to perform. The injudicious use of any appliance in dental practice tends to force it into disrepute. When a denture is being designed, care should be exercised to study the need for retaining devices. They should be logically located, the smallest number possible being used to obtain the desired results with a reasonable allowance for what the engineer terms his "margin of safety." Dr. Rudd's contention that unilateral saddles posterior to the abutment tooth or teeth should be supported by a palatal strap or lingual bar attached to a direct retainer on the opposite side of the arch should also be emphasized. If these restorations are not required to function efficiently in mastication, the abutment teeth may withstand the stress for a long time, but what is the use of inserting artificial restorations in that part of the mouth where mastication is the chief function, if the appliances have very little utilitarian value? I commend this method of handling partial denture cases to you for a thorough and careful trial.

Richard L. Simpson, Richmond, Va.: The two outstanding objections to partial denture practice have been (1) the extreme difficulty of securing perfect impressions in all cases, and (2) when clasps are used, the loosening of the teeth after the dentures have been worn. When we consider how embarrassing these two features have been, our minds are open to any suggestion that will improve

things. The technic systematized by Dr. Rudd is a solution of the first difficulty, relieving anxiety and nervous strain. The second difficulty is largely overcome by his ingenious stressbreakers and the ability to use more and proper clasps. There are many more good features to the system, and your enthusiasm will increase with its use. Your ideals will be raised decidedly, possibilities will open up that you formerly despaired of. The certainty that the denture will go to place is well worth adoption of the system. Several years of using the technic and of teaching it compel me to a wholehearted endorsement of it. The profession is a debtor to Dr. Rudd for his efforts.

THE RELATIONSHIP OF THE DENTIST TO THE OBSTETRICIAN*

By W. C. DANFORTH, M. D., Evanston, Ill.

OF late years, more and more interest and attention have been given to the care of women during pregnancy. The results of intelligent and conscientious observation have been shown in decreased maternal mortality and morbidity. Intelligent women no longer postpone medical attention till labor is imminent, but place themselves under medical supervision early in pregnancy. This enables the physician to detect and, in many instances, remedy conditions which might interfere with the normal course of the pregnancy. If any condition which is found is irremediable, the medical attendant, being aware of its presence, is, at least, better able to cope with it. Pregnancy has been referred to as a disease of nine months' duration. This is not a new observation, as Mauriceau refers to it in his book printed in 1690 as a common saying. While we scarcely subscribe to this fully today, there are many conditions arising in pregnancy which deviate more or less from the normal and which need attention. Pregnancy and labor impose a definite and considerable strain on woman, and it is essential that she be kept in the best physical condition while going through them. The first great essential, then, in dealing with a pregnant woman is that a careful appraisal of her general physical state be made. Following this, detailed inquiry into any particular abnormalities which may have been discovered should be carried out.

For years past, cooperation between physicians working in various fields of medicine and dentists has been increasing. The tremendous importance of the relationship of dental infections to disease in other parts of the body has come to be generally recognized. This has led to a greater dependence of one group on the other, a state of affairs which is to the best interests of both groups, and, what is more important, to the best interests of our patients. Physicians have learned something of dental pathology and the dentists have come to understand more of the problems of general medicine. Let us hope

*Read before the Section on Mouth Hygiene and Children's Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

that this rapprochement may continue and become closer. It is difficult to separate any portion of the human anatomy so completely from its surroundings that it stands wholly by itself. The specialist who isolates himself within the narrow boundaries of his particular field of work is never the most successful practitioner. He is wiser who occasionally looks about over the adjacent fields of activity, in order that he may have at least a general idea of what is going on in them.

It would be a presumption for an obstetrician to attempt to discuss questions of dentistry before a society of experts in that field. I shall therefore approach my subject wholly from the standpoint of the physician who is dealing with obstetrics and diseases of women. The safe conduct of women through pregnancy often requires that the obstetrician receive the cooperation and advice of workers in other fields of medicine. Of these, none is so frequently sought as the dentist, for, while specialists in other fields are needed only occasionally, every pregnant woman should have dental attention.

We may consider our subject under two divisions: first, the necessary care which should be given the teeth in order to prevent injury to them during pregnancy, and, second, how proper dental care and advice may aid in preventing some of the complications of pregnancy.

The preservation of the teeth during pregnancy requires no great expenditure of time or effort, in most cases, by patient, dentist or physician; yet, unfortunately, it is often left undone. The responsibility for this rests far more often on my profession than on yours; for it is the physician who first sees the pregnant woman, and it is to him she looks for advice as to the course she is to follow. This may best be managed by a short and clear discussion of the important points in the hygiene of pregnancy, which should take place at the first visit of the patient to the physician's office. It should immediately follow a careful physical examination, in the course of which the physician inspects the patient's teeth. It may be asked why he, without dental training, should do this. One may with equal justice ask why the obstetrician, who is not an internist, should examine her heart, lungs and throat. Should he find abnormalities in any of these, he refers her to the person who may wisely advise her. A display of real interest in all these matters will impress the woman that the physician is in earnest about them far more than will a desultory discussion unaccompanied by any effort to find out about them. There is this difference, as far as my own practice is concerned, that the woman is invariably asked to see her dentist, while requests that she see the internist, throat specialist, etc., are only occasionally made. The woman is always told to tell the dentist that she is pregnant. A few words of explanation as to the importance of dental care is as a rule sufficient.

Experimental efforts to explain exactly why dental damage occurs more rapidly during pregnancy have apparently not been wholly satisfactory. Such investigations must be made on laboratory animals, in which the manner of growth of the teeth is quite different from that in the human being. Therefore, reliable inferences cannot be drawn, and we are compelled to content ourselves with the results of clinical observation.

There is no doubt that cavities in the teeth increase in size more rapidly during pregnancy than at other times. This

may be due to an alteration in the character of the mouth secretions, or to a demand for calcium, which is greater during pregnancy than at other times, owing to the demands of the growing fetus; or possibly to both. The idea that the calcium demand of the fetus causes destruction of the teeth is not a very satisfactory explanation, and I am inclined to believe that an alteration in mouth fluids has more to do with it. This damage may be combated in three ways: (1) by proper dental attention to any cavities which may exist, together with scaling and cleaning of the teeth; (2) by prescribing a diet containing adequate amounts of calcium, and (3) by care of the teeth by the patient herself, painstaking dental cleanliness and the use of alkaline mouth washes.

In my work, an attempt is made to have every pregnant woman have all cavities at least temporarily filled and the teeth carefully scaled and cleaned. Pyorrhea should be eradicated if possible. My impression, gained from dental friends, is that the eradication of pyorrhea represents an ideal which is difficult of attainment, but at least consistent efforts at its control should be made. Infections about impacted or partially erupted teeth should be searched for and corrected. Foci of infection, wherever located, should be eliminated from the system of every pregnant woman.

The opinion which is still apparently held by a portion of the public that dental work should not be done during pregnancy is entirely wrong. It not only can be done, but it is also imperative that it should be done. If extensive work, accompanied by some discomfort, is required, some form of temporary filling may be used. The proper method of procedure is one for the dentist to determine.

A disadvantage of temporary fillings is that the mother, busy with her new baby, may not return to the dentist as soon as she should to have them replaced by more permanent work. This difficulty, like many similar ones, is in inverse ratio to the intelligence of the patient. It is a matter of observation by many obstetricians that pregnant women will undergo any reasonable amount of dental work without any great risk of miscarriage. I have so far not seen any case of miscarriage which has been due to dental work. Extractions are quite unlikely to cause miscarriage. In the course of years of private and hospital practice, I have not seen it occur. If the patient can be induced to undergo it, dental inspection two or three times during pregnancy is of even greater advantage. Intelligent patients of the better class will do so readily.

The question of diet should be settled early in pregnancy. The necessity for a sufficient calcium supply is apparent. The usual advice which is given is that a quart or more of milk be taken daily. This will supply the calcium and, in many cases, may be quite satisfactory. Of late years, however, it has been borne in on obstetricians that a too great weight increase during pregnancy carries with it an increased risk of toxemia. We find it of definite advantage to our patients to limit the gain in weight during pregnancy to 20, or at most, 25 pounds. In many women, particularly those who take on weight easily, a large milk ration, with its consequent increase in fat intake, causes the weight to rise too rapidly. The administration of milk must therefore be limited by the necessity of preventing too great an increase in weight. The lime in milk was obtained

from the green food eaten by the cow, and women may easily obtain it from similar sources without risking any undue gain in weight. Lettuce, spinach and cabbage should be prescribed, and the pregnant woman should be advised to have them often on her table.

In the infrequent instances in which a distaste for these foods exists, calcium may be given in the form of one of its salts, usually calcium lactate. This is rarely necessary.

The fibrous new growth known as epulis is prone to occur during pregnancy. It usually springs from the periosteum of the jaw edges and may grow more rapidly than at other times. It is not a frequent complication of pregnancy. When found, it should be removed, which may be done without the necessity of extraction of teeth. The appearance of such a growth requires the cooperation of the oral surgeon or dentist.

In some women, the mouth fluids become quite acid; occasionally, enough so to damage the tooth covering, especially along the gum lines. The use of alkaline mouth washes will assist in controlling this. Gingivitis is occasionally seen by the obstetrician. The only remedies with which he is acquainted are dental cleanliness and the use of mouth washes. Should these not promptly succeed, he must ask for assistance from his dental friends. I believe that there is some ground for the belief that the gums exercise to some degree an excretory function. Evidence of this is seen in the salivation occurring in mercurial poisoning. It is possible that there may be a similar explanation for the ptyalism which is occasionally seen in pregnancy, and which may be caused by the excretion of toxins peculiar to pregnancy. This complication is likely to occur in women who are suffering to a greater or less degree from the early toxemia of pregnancy. It is sometimes extremely distressing, and, in the severe cases, there appears to be but little that either dentists or physicians can do which has any really curative effect. Fortunately, severe cases are not common. I have seen but one in several years. The milder ones usually disappear of themselves as the pregnancy proceeds and the early toxemia wanes.

The second division of our subject concerns the relationship between dental pathologic conditions and certain complications of pregnancy. In general, it may be said that the woman with infected teeth is not in as good health as the one whose mouth is in healthy condition. Specifically, there are three common complications of pregnancy and labor, the frequency of which may be diminished by careful attention to the dental condition. One of these is miscarriage. It may seem a far cry from infected teeth to miscarriage, but the modern obstetrician does not consider it so. There is considerable reason for thinking that a certain number of these accidents of pregnancy occur because of infections of the placenta of hematogenous origin. Such infections may produce infarcts or infected areas in the placenta. These are found suspiciously often in the placentas of abortions. Curtis has recently drawn attention to the importance of focal infections as the causes of abortion. The woman to whom the distressing accident of pregnancy has occurred should undergo careful search for such foci, and an important part of such an investigation is the study of the teeth and particularly the tooth roots. As to this investigation, while it is peculiarly the province of the dentist and should be carried out by him, the obstetrician may

perhaps suggest that roentgen-ray studies are an important part.

Any woman who has been unfortunate enough to abort a number of times should receive such attention without waiting for the beginning of another pregnancy. Experience seems to show that careful search for and elimination of foci from which pyogenic organisms may get into the blood will, in some cases, make it possible for pregnancy to proceed normally. I have on more than one occasion found freshly infarcted areas in the placenta in cases of abortion which, on section and histologic examination, showed definite evidence of inflammation.

The finding of root abscesses in the mouth of a pregnant woman brings up at once the question of extraction. The answer of her obstetric attendant should at once be that the infected teeth should be eliminated. My own preference is that an extraction should be done under local anesthesia, and preferably at the hands of some one who possesses sufficient skill, experience and deftness in this work so that operative trauma, shock and postoperative discomfort are minimized to the greatest practicable degree. I must admit that extractions performed under less favorable conditions have not caused abortion, although the recovery may not be so smooth.

One of the three great causes of death in pregnancy and labor is toxemia and eclampsia. We must admit that we cannot state definitely the cause of toxemia and eclampsia although certain predisposing factors are known. The experience of many able obstetricians of late years has shown that the incidence of these toxic states can be greatly decreased. The two most important points in the prevention of toxemia are (1) the prevention of excessive increase in weight, that is, the avoidance of the ingestion of unnecessary amounts of food, and (2) the elimination of focal infections. The relationship of infections to toxemia is definitely recognized. It is of course not the only cause, but must be numbered among the conditions which are regarded as predisposing causes.

A condition which imposes additional burdens on the already heavily loaded eliminative organs of the pregnant woman cannot fail to increase her likelihood of developing toxemia. Obstetricians admit freely that the exact mechanism of the production of pregnancy toxemia is unknown, but certain predisposing factors are made evident by clinical experience and observation. Such experience seems to show that the presence of foci does increase the risk of toxemia. The presence of bacteria and their toxins in the circulation must increase the burden of, as well as irritate, the liver and kidneys, which are the two organs most concerned. Lessening of such irritation and diminution of physiologic overloads, without question, diminish the number of cases of toxemia. The two most important ways of doing this are the limiting of food ingestion to the real necessities of the patient, and the elimination of all pus foci. The foci most commonly requiring attention are the tonsils, skull sinuses and the teeth.

Again, the necessity for the cooperation of a painstaking and careful dental collaborator becomes apparent. All women in whom toxemia has occurred in previous pregnancies should have an oral investigation with these possibilities in mind.

The gynecologist and obstetrician sees two classes of patients in his work in whom phlebitis, or infections of the large veins of the pelvis and upper thigh, is apt to occur. The two classes are women whose uteri are removed for fibroid

tumors, and women who have recently been delivered. The reason why these two groups are peculiarly liable to such infections is that, in both these groups, the large venous trunks of the pelvis are contused, and subjected to pressure and, in the case of operation for tumor, to instrumental trauma. This produces for the time a *locus minoris resistentiae*. Should bacteria be in the blood stream, they are prone to locate in any area the resistance of which is lessened. It is a matter of experience with many obstetricians that phlebitis in obstetric cases occurs without much reference to the type of delivery. The specialist who sees many cases is sometimes disturbed by the fact that a woman whose labor has proceeded smoothly, rapidly and normally will have phlebitis, while others who have undergone operative delivery have none. One of the severest cases of phlebitis that I have ever had occurred in a woman who had a very rapid and perfectly normal delivery, without one internal examination and with no laceration. She had, at the time of labor, an infected tooth, which was suppurating. A purulent discharge was visible at the edge of the gums. This was early in my experience and before the importance of focal infections was as well understood as it has been in recent years. It was a good object lesson. Such situations have been promptly dealt with since then. Again, a short time ago, a patient in the ninth month of pregnancy developed an antrum infection. Although this was at once treated by an excellent laryngologist, her labor, which came on before the antrum infection was done away with, was followed by phlebitis. Experiences of this sort are too common for us to fail to recognize the relationship. Indeed, I believe that phlebitis is more often due to some hematogenous infection than to infection introduced at the time of labor. The necessity for the collaboration of the specialist in whose field the infection lies is at once apparent. No one's help is so often needed as that of the dentist, for root abscesses are probably the most frequent source from which such hematogenous infections arise.

SUMMARY

We may say that there is a definite and real relationship between the work of the dentist and that of the obstetrician. It is well worth while to the expectant mother for us to make it possible for her to pass through pregnancy with little or no damage to her teeth, and this is entirely possible if her obstetric attendant is alive to the importance of this phase of prenatal care, and if his suggestion as to dental inspection and correction of defects is thoroughly carried out by the dentist. It is even more important for the safety of the pregnant woman that she be protected against obstetric complications which may result from neglected dental infections. From the standpoint of the active obstetrician, I can say emphatically that the cooperation of the dentist is an important and valuable aid in the conduct of our patients through pregnancy, and one upon which, at present, we do not fail to place a high value.

INTERPRETATION OF THE DENTAL ROENTGENOGRAM*

By FREDERICK F. MOLT, D.D.S., Chicago, Ill.

THIRTY-TWO years have passed since Roentgen discovered the ray which bears his name, and almost that many since the first dental roentgenogram was made. Seventeen years have gone by since Hunter exploded a bomb shell in the dental world by his article in the *Lancet*. Almost that many have elapsed since Rosenow gave us the first results of his experimentation in focal infection, to be corroborated by Billings, Post, the Mayos and an increasingly larger group of medical men. Yet today we have dentists audacious enough, in the face of all this knowledge, to tell their patients that pulpless teeth are not a source of infection. This prompts us to repeat and accentuate points of diagnosis on which there seems to be so much misinformation and willful misstatement.

The roentgenogram, if properly made, does not lie. There may be conditions on which it can give limited information or no information at all. It may be misinterpreted, no matter how carefully made, and there may be certain apparent conditions the existence of which must be determined by clinical examination, or in which the element of doubt can only be eliminated by operation—where indicated.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

THE PROPERLY MADE ROENTGENOGRAM

What constitutes a properly made roentgenogram? It should be of clear texture or photographic quality. All possible value and contrast should be obtained by proper exposure, development and washing. It should not be too dark or too light. The dark film is overexposed and the light film either underexposed or underdeveloped. An overexposed film that is underdeveloped in order to avoid excessive density lacks detail. If underexposed, no amount of developing will bring it up to proper texture, but it will make it yellow. The use of old or improperly mixed developing solution may also fail to bring out the necessary detail even in a properly exposed film, and will yellow the film. Inadequate washing will cause the dried film to have a brownish, greasy, muddy appearance. Such a film is of no value for future reference because of its rapid deterioration. Above all, the film should be kept from fogging during the entire process of exposure and development.

FOG

To avoid fogging, be sure that the films are protected from any exposure to the roentgen-ray other than that intended. Secondary radiation can fog films not kept in a metal container, if adjacent to the roentgen-ray machine. The dark room should be light-tight, and the dark room light properly protected

so that it cannot possibly fog the film. One should be sure as well that developer, sodium hyposulphite and wash water are of equal temperature, 68 F., and thus avoid chemical fog.

EXPOSURE AND DEVELOPMENT

Proper exposure requires, primarily, the positioning of film, patient and tube so that the entire tooth or area is shown without any, or with the minimum of, distortion. The exposure time varies with different films and with different machines and must be worked out by each operator as part of his technic. Penetration should not be greater than 4 inches to achieve desirable contrast. The exposure time should be only sufficient to develop to desirable photographic detail in five minutes at 68 F. Thus, the development of the film is the definite means of determining exposure time.

The film having been exposed the required time and developed for five minutes, it should be passed through the wash water to take away the greater part of the developer before it is carried into the sodium hyposulphite. Here, it is kept twice as long as is required for it to clear, and it is then washed for at least twenty minutes in clean wash water—preferably running water.

If these rules are followed, one will not have to guess as to what the roentgenogram shows, or to be apologetic about the result.

INTERPRETATION

The reading of a roentgenogram is only part of a diagnosis, although there are those who apparently consider it all that is required. Lack of familiarity with the anatomy of the skull or the roentgenographic appearance of various structural deviations leads to frequent errors. Every radiolucent area is not necessarily pathologic; the radiolucence may mark the nasal fossa, canine fossa, maxillary sinus, incisive fossa, mental foramen, inferior dental canal or the mylohyoid groove. Consider these first.

Radiolucent areas existing at the apex of teeth may indicate either granuloma, pericemental abscess or radicular cyst, and it is frequently impossible to determine from the roentgenogram which is present. For that matter, it is frequently impossible to say which we have found when we have operated.

Some members of our profession claim the ability to tell from the roentgenogram whether existing periapical areas are "harmful" or "harmless"—presumably whether they are pathologic or not. Simpson has well designated the power as "radiographic clairvoyance." It may positively be stated that the existence of any periapical area indicates that the tooth is pulpless.

THE PULPLESS TOOTH

Probably the greatest fallacy in determining the presence of oral foci of infection is that of pronouncing as safe or harmless the pulpless tooth that shows no periapical destruction. Price has demonstrated that the existence of an abscess or granuloma indicates merely a higher resistance on the part of that patient. Under any circumstances, if such a lesion exists, the tooth itself has been the source.

One conversant with focal infection findings, or sufficiently open-minded to observe a group of patients presumably suffering from diseases of such origin, can arrive at but one conclusion—that no pulpless tooth is ever safe in the presence of serious focal infection disease.

Reports from the Mayo Clinic on the examination of 1,417 patients showing the percentage of those examined who

had infected teeth are presented in the accompanying table.

PERCENTAGE OF GROUP OF CASES AT MAYO CLINIC SHOWING INFECTED TEETH

Diseases	Percentage having infected teeth
Stomach conditions	90.2
Duodenal and gastric ulcer	92.0
Poor general condition	86.6
Arthritis	87.8
Myositis	89.5
Heart lesions	88.1
Kidney disease	92.9
Backache	88.7
Headache	88.0
Neuritis	90.0
Gallbladder disease	91.5
Anemia	92.5
Goiter	87.5
Ear trouble	94.7
Miscellaneous diseases	87.3

Quite true, there may be other foci of infection, notably tonsils and sinuses, but the existence of these other foci in no way detracts from the potentiality of the dental foci. It should not be overlooked, moreover, that each pulpless tooth presents a separate focus and that there are therefore thirty-two possible foci of this type.

The roentgenographic evidence of the tooth's having been devitalized and the canal filled is, of course, *prima facie* evidence that it is pulpless. It is possible for a tooth to be pulpless and infected with no roentgenographic appearance of canal filling, or of periapical disease, without, in fact, there being a crown or a filling of any kind shown.

Any deep filling or inlay creates a doubt as to the vitality of a tooth, and clinical examination with the use of the vitality test (although itself not infallible) should be resorted to in an effort to amplify the roentgenographic interpretation.

Pain symptoms have little significance other than in connection with acute abscess conditions. If the acute disturbance is incidental to the lighting up of an old, chronic area, the roentgenogram will disclose it. If the infection is the original acute abscess following the disorganization of the pulp, the roentgenogram may be of little or no value.

GINGIVAL INFECTION

Whatever may be the cause of pyorrhea, it cannot be overlooked as a source of systemic disease. The roentgenographic evidence of such destruction should be checked by clinical examination of the mouth. Since, in many cases, pockets on the lingual aspect of the teeth may be inadequately shown in the roentgenogram, the condition may be much more extreme than the roentgen-ray would indicate. Frequently, on the contrary, when the destruction has been arrested, and the gum tissue is hard and firm, the appearance in the roentgenogram may be extreme because of past bone absorption. Careful examination and a probing of pockets and interdental spaces should therefore be resorted to in order to verify indicated conditions.

The tissue pocket or operculum covering an incompletely erupted lower third molar is an apparently potent source of systemic as well as acute local trouble.

DIAGNOSIS

Up to this point, we have been concerned with making and verifying an interpretation of dental roentgenograms. The decision now must be as to what should be done with teeth which we may label as "potential" sources of systemic infection, meaning that they have the power to cause disease. This is about as far as the dental diagnostician can assume to go. To enter into a discussion of existing symptoms of systemic disease

is rather presumptuous, as that is not the dentist's field. On the contrary, when an oral diagnosis is required, for him to state that pulpless teeth or pyorrhea pockets cannot possibly be the source of existing systemic trouble is ridiculous and ill-advised. The dental consultant should systematically enumerate the possible dental sources of disease, leaving to the physician, whose field it is, and whose prerogative it is, the matter of linking these up with the general diagnosis.

There are two bases for determination of indicated procedure—dental and medical. On the dental aspect alone, all teeth with extensive periapical areas should probably be condemned; all lower third molars with partial tissue coverings should be extracted; and, in pyorrhea cases, if two-thirds of the root attachment is destroyed, extraction rather than treatment should be advised.

It is utterly illogical to attempt, on the roentgenographic evidence, to choose between two pulpless teeth—stating that one is "worse" than the other. The organism that is recovered from one pulpless tooth will invariably be recovered from the others, abscessed or not. One should, moreover, not be so short-sighted as to let restorative convenience influence the decision as to extraction and retain one tooth while extracting its neighbor, both being equally bad. To be sure, if part of the pulpless teeth are removed, the foci are reduced numerically, but those remaining may shortly or eventually require extraction.

Many dentists are quite ready to pass judgment on teeth repaired by the work of others and yet reluctant to condemn any of their own efforts. It is essentially the patient's own fault, in the majority of cases, if a tooth has broken down to such a degree as to require devitalization; therefore, the burden of responsibility should be borne by the patient, the dentist essaying only to accomplish everything possible with the situation, but not under any circumstances guaranteeing safe results. No matter how carefully canal treatment and filling operations are done, no matter how skilled and conscientious the operator, these teeth may go wrong. Therefore, let the patient understand the situation thoroughly.

The patient should be informed that the "roentgenographically negative" dead tooth presents primarily a medical problem; that, while always open to suspicion, these teeth may be retained on parole or good behavior, in the event that there exists no systemic aberration of focal infection origin; that the advisability of a conservative or radical decision should be determined by the physician, and that in those cases in which practically all teeth are pulpless and pyorrhea is involved, a *complete* extraction is probably indicated.

The matter of "resistance"—that intangible thing that cannot be measured by any means now known—is the index. The summing up by the physician, who views all evidence in relation to disease, is really the only way to reach a logical decision.

It is no doubt radical, although preventive, medicine to condemn serviceable teeth of this type unless a real medical reason is present. If a rational sense of proportion exists, and an honest desire to collaborate with the medical diagnostician, our field of vision will comprehend more than just teeth. The ultimate in achievement is to keep the patient well or to cure him if he is sick. Masticatory efficiency, although important, is secondary to this. Dental ingenuity can replace a lost tooth, or many or all teeth; a

diseased kidney, or gallbladder or heart cannot be replaced.

25 East Washington Street.

DISCUSSION

E. W. Browning, Salt Lake City, Utah: We are all agreed that a properly made roentgenogram is most essential to a correct diagnosis. Dr. Molt did not mention anything about the film itself. The manufacturers of dental films have spent considerable time and money to give us a better film, a speedier film and a film that will bring out better detail (such as the highly duplitized film), and yet two important details have been neglected. However, the blame lies with us because we have not demanded or even asked for a change. Except in the hands of such men as Raper, Simpson and a few other specialists who by constant practice have mastered the technic, the efficiency of the dental film of today is reduced about 50 per cent. The main reason for this inefficiency is the distortion found in the majority of roentgenograms. This distortion is due, first, to the pliability of the film and, secondly, to the size of the film. A large number of roentgenograms are produced by untrained persons, such as dental assistants; which makes it all the more important that distortion be minimized. Distortion cannot be minimized as long as we use the same sized film in all parts of the mouth, and especially is this true in the case of a constricted arch. Distortion can be eliminated by the use of a stiff metal backed film made in different sizes to fit different parts of the mouth, such as has been advocated by McCormack. Another important factor in interpretation is the view box. A poorly made roentgenogram, when viewed before a properly lighted view box, will show more detail than a properly made roentgenogram before a poorly lighted view box. Some of our early pioneers in dental roentgenography wisely condemned the reading of roentgenograms by the window light method, yet, from the way this is practiced today, their warning fell on deaf ears. Owing to the varied degrees of dentistry found in roentgenograms, we should have a view box in which the light can be increased or decreased to obtain the maximum of detail from the case on the box. I must take issue with Dr. Molt when he says, "It may positively be stated that the existence of any periapical area indicates that the tooth is pulpless." We have a few cases of cysts surrounding the apical third of teeth in which the nerve and blood supply are evidently pushed to one side and the tooth gives a positive vitality test. However, I doubt the feasibility of a successful removal of the cyst without injury to the pulp. To quote Dr. Molt: "To enter into a discussion of existing symptoms of systemic disease is rather presumptious, as that is not the dentists' field." Granting that this is true, I should like to ask Dr. Molt what his procedure would be with a patient whose physician disregards the teeth as a possible foci. If we adhere to the outline as suggested by Dr. Molt, better roentgenograms and better interpretations will be the result.

Clarence O. Simpson, St. Louis, Mo.: As a discriminating observer familiar with the character of roentgenography as generally practiced, Dr. Molt presents a paper which is principally devoted to fundamentals. Although it is rather discouraging that this condition prevails, his judgment is sound in choosing this appropriate text. Since roentgenographic evidence is essential for efficient dental service, and the value of the evidence is dependent on the quality of the roentgenography, and the accuracy of the interpretation; the necessity for primary instruction at this time is significant. High-pressure salesmanship appealing to avarice and egotism has led the majority of dentists to install alleged automatic roentgen-ray equipment, when general practice was already so complex and diversified that only a superman could become proficient in all of its branches. The distractions of multifarious other duties interfere with intensive study of roentgenography by dentists, and since the operator is usually the sole judge and critic of the service, there is no compulsion for improvement. Demonstrators of roentgenographic supplies report that most dentists do not appear to be interested in roentgenography beyond the fees which it will procure by claims of superior service. Since only dentists perform the operations indicated by dental roentgenography, they would be expected to establish and demand a high standard of service to guide them properly. They have not generally exercised their legitimate censorship, but have tolerated and contributed to the exploitation of roentgenography. Dr. Molt has described and emphasized many of the essential features in roentgenographic technic and interpretation. The statement that an overexposed film which is underdeveloped lacks detail conveys the impression

that this procedure seriously impairs the quality of the image. A test will prove that overexposure up to 35 per cent may be corrected in development without loss of diagnostic value. This comment is not intended to encourage careless exposures, but to emphasize the permissible latitude of overexposure which will save many negatives. Dr. Molt states that one should be sure that the developer, sodium hyposulphite and wash water are at 68 degrees to avoid chemical fog. In view of the many precautions which are necessary, it would be a useless task to keep all the solutions at the same temperature when there is no practical objection to the sodium hyposulphite and water ranging from 50 to 70 degrees. Temperatures within this latitude will not cause fog or other ill effects to films, and the caution should be concentrated on the developer. Developer may be successfully used at 68 degrees, although most authorities advocate 65 or 66 degrees, which is safer. With the difficulty of maintaining an exact temperature and the inaccuracy of thermometers, developer intended to stand at 68 degrees is likely to exceed 70 degrees, with danger of chemical fogging. In this connection, the exposure should be just sufficient to give the desired density of the normal development time, but this is not easily accomplished and slight modifications of development are more feasible. Under "interpretation," the positive statement that the existence of any periapical area (presumably radiolucent area) indicates that the tooth is pulpless should except the results of trauma and disuse atrophy which produce perplexing periapical changes. The summary of the pulpless tooth danger might be classed as a dental rather than a medical point of view, since internists are generally not so positive or radical. It is a peculiar evolution that the medical profession as a whole gives more consideration to oral sepsis than the collective dental profession, but the extremists in pulpless tooth condemnation are almost without exception dentists. We may safely agree on the elimination of dental disease, but the experimental removal of all pulpless teeth has not been established as rational practice.

Dr. Molt (closing): Dr. Browning questioned that the existence of the periapical lesion necessarily means that the tooth is pulpless. It is a matter of misinterpretation rather than a difference. Of course, what I had in mind was the existence around the apex of the individual tooth, not the overlapping of the root by a lesion originating with an adjacent tooth. Dr. Browning also asked, in regard to the discussion of the patient's general symptoms, what I would do in the case of a patient whose physician ignored the possibilities of oral infection. Speaking generally, the majority of patients come to us for oral diagnosis either from a dentist or from a physician, but if an unreferred patient whose physician apparently ignored the existence of oral foci manifest in the roentgenogram were in my hands, and if that patient were apparently suffering from systemic lesions that might have focal origin, I should be inclined to advise him to get another physician. Naturally, ethical considerations cannot be ignored, and frequently, much as we would like to speak of these things, we must refrain. Dr. Simpson brought up the matter of the dentist's being his own interpreter, and the point that, being his own interpreter, when he makes the roentgenograms himself, he is altogether too easily satisfied. When attending meetings, I am frequently asked to give my opinion about a case which I have never seen and probably never will see, from the roentgenogram. If the film were properly made, I might have no reluctance to venture an opinion, and only an opinion, but I must often tell the dentist that the roentgenogram is so distorted, so black, or so light, that I do not care to venture an opinion as to the condition. I differ with Dr. Simpson to a degree on the matter of the overexposure of the film, and the underdeveloping to make up for that overexposure. There is a certain amount of latitude of course, and the experienced man realizes just how much latitude he has. If you don't make definite points and accentuate them, the inexperienced man, doing comparatively little roentgenography has nothing tangible to work on. I differ with Dr. Simpson as to the dentist's being the extremist in the majority of cases because I find that physicians, in many cases, are liable to condemn pulpless teeth and vital teeth alike without any consideration of an oral interpretation. I used a term in my paper that I would reiterate, "a rational sense of proportion." I don't want you to think that I am so extreme as to advocate the extraction of *all* pulpless teeth under *all* circumstances. I do not. The patient's physical condition is logically the index which decision should be made.

OUR COLOR, LILAC

By D. M. CATTELL, A.M., D.D.S., San Francisco, California

ONE day, shortly after "Polk's Dental Directory" of 1925, was out, with its lilac binding, a student of the graduating class asked, "Why the delicate color?" I told him that lilac was the emblematic color of our profession. Immediately he asked why and who selected the color. I could not tell him. I inquired of many of my confréres and none of them could tell me. I became interested. I wrote to the editors of all the dental journals that I could think of, but few gave me any help. Many "had never thought about it" before I wrote and asked the question. I also wrote to the dental historians (of whom we have but few left); and as they could give me but little information, I wrote to all my friends whom I thought might know something as to who suggested that we have a color and why. Before me, I have the answers, a great pile of them, from which I gather the following history.

It seems that the Intercollegiate Commission[1] (whatever that was), in 1894, composed of the presidents and trustees of universities, met, I think it was at Harvard University, to talk over colors then belonging to certain professions and selecting other colors for those remaining that had not a color emblem. The consensus of opinion was that lilac should be the color emblematic of the dental profession as green was of medicine, scarlet of theology, royal purple of law, olive of pharmacy and blue of philosophy. All this was done with reference to ideas of a firm of cap and gown makers of Albany, New York, who conceived the idea of showing the colors belonging to each profession or degree as a lining or binding to the hoods belonging to the respective gowns. So, we see the idea was academic and out of our hands as a profession. The idea was that, when a certain gown was worn by a professor on the platform or in the procession, the color on the binding of the hood of his gown would indicate to the observers to what profession he belonged or what degree he held.

But how did the idea come to be accepted by our profession? Imbued with the spirit of the occasion, Mr. Gardner C. Leonard, of Cottrell & Leonard, of Albany, New York, carried the idea that he conceived at this gathering of the academic world at Harvard with him to the meeting of the National Association of Dental Faculties in Saratoga in 1896, and presented the proposition to them, suggesting that it would be a great help in systemizing the academic idea of colors. Thomas E. Fillebrown then moved that the color lilac be chosen as emblematic of the dental profession. The motion was carried and lilac became the emblematic color of our profession.

1. Who authorized the gathering of the Intercollegiate Commission I do not know.

In the minutes of the 1896 annual meeting of the National Association of Dental Faculties, I find the following:

On motion, Mr. Gardner C. Leonard of Albany, New York, was given permission to exhibit gowns and caps, illustrate the code, language and significance of gowns, with a view of selecting a color for the dental profession. On motion of Dr. Thomas E. Fillebrown a committee of three consisting of Doctors J. D. Patteson, W. H. Morgan, and E. C. Kirk was appointed to select and recommend a distinctive color for the trimmings of academic costumes for the dental degree.

The committee on selection of a distinctive color for the dental profession then made the following report:

"Your committee on choosing a color respectively report that they have decided to recommend the standard lilac as a distinctive dental color and they recommend the adoption of the academic costume according to the requirements observed by the intercollegiate system.

On motion, the report of the committee was adopted.

This is the story of the origin of our color as I have received it from many sources, through correspondence. I have the very piece of lilac ribbon that was shown and approved at the National Association of Dental Faculties at Saratoga in 1896. It goes to the museum of antique instruments in the University of California, College of Dentistry. It seems to me that this is a bit of the history of our profession that is not generally known, and should be, so I have undertaken to produce it. If I have erred, I will accept correction gladly.

This bit of ribbon, presented to me by B. J. Cigrand of Batavia, Ill., was presented to Dr. Cigrand by Dr. H. L. Ambler of Cleveland, Ohio, who was a strong advocate in favor of its selection and strong in his sympathies with the academic procedures.

I have recently run across a paragraph from H. L. Ambler's "Facts, Fads and Fancies," stating: "At Saratoga in 1896 the N. A. D. F. adopted lilac as the dental color. For this reason, our colors on the cover of our book."

INDICATIONS FOR VARIOUS TYPES OF OPERATIVE RESTORATIONS FOR THE ADULT*

By DONALD M. GALLIE, D.D.S., Chicago, Ill.

RECENTLY, there appeared in two different numbers of one of our leading journals, two notable contributions, one a paper by the dean of one of our outstanding schools, the other by the editor of the journal. Both sound a warning about decline and loss of leadership of operative dentistry. Our journals, and the programs of our different meetings, have given little space in recent years to operative procedures, aside from the technic of the cast gold inlay. Few papers or clinics have been presented on foil, amalgam and porcelain restorations, and as popular as the silicious cements

*Read before the Section on Operative Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 25, 1928.

seem to be, no one has had the courage of his convictions and presented anything on the subject.

The foundation, cornerstone and superstructure of dentistry is the filling of carious teeth with well-selected filling materials.

The question of what is best in filling materials has always been the cause of much difference of opinion in the ranks of the profession, and has brought about the bitterest controversy in the history of dentistry. In fact, it at one time created a feud, and for some time divided the profession into two hostile camps—one, the advocates of gold foil, and the other, the new departure camp, who declared that gold was the zero of filling materials and that amalgam was the ideal restoration for any location in the mouth.

Again, about twenty-five years ago, the profession was somewhat divided over the relative merits of foil and porcelain. Many excellent operators declared that the day for foil restoration was ended, and that porcelain was king and that there was no limitation to its use unless it was the limitation of the dentist's skill.

In the days of our dental ancestors, from Hayden and Harris to our own Black, dentistry was divided into two branches, operative and prosthetic. Our ancestors were usually masters of both. Today, dentistry is divided into as many specialties as mother medicine, I think; according to our literature, about eight; but in spite of these supermen, we are not overtaking the ravages of caries, and, in the opinion of some, we are not filling these carious teeth any better than did our ancestors. I am wondering whether we will see the same reaction relative to specialization that medicine is now going through. The trend in medicine is to get back to the bedside, or general, practitioner. Perhaps we too will aim to get back and regain our leadership by saving more teeth by well-selected fillings.

There are many factors to be considered in the selection of suitable filling materials, and as Webster said in a recent article, the convenience of the operator or the plethoric purse of the patient should not be the deciding factor. We must take into consideration the age of the patient, the physical and mental condition, the susceptibility or immunity of the teeth to decay, the condition of the surrounding tissues, the stress of mastication, the esthetic requirements and, too often, the limited means of the patient.

Certain well-known qualities are necessary in a filling material that is to be considered a permanent restoration. It must be indestructible in the fluids of the mouth; it must withstand the stress of mastication and attrition; it must not change form; it should be capable of adapting itself perfectly to the walls of the cavity and of excluding moisture. There are other desirable qualities, but the ones I have mentioned are absolutely essential.

Most writers, in discussing the qualities of filling materials, admit that gold foil is the peer of all materials as a permanent restoration. It is indestructible in the fluids of the mouth, stands the stress of force, does not change form, and does not change color or discolor the teeth. It can be perfectly adapted to the walls of the cavity and protects the cavity margins, which is so essential, as no other material does. It has two disqualifying features: lack of harmony in color, and conductivity of thermal changes. The latter can be overcome somewhat by some form of insulation. In spite of the many good qualities of foil and its past record as an ideal restoration, there are fewer foil fillings inserted today than any other, with the exception of the porcelain

inlay. From the replies to a questionnaire sent out by a prominent operator a few years ago, it would appear that a foil restoration is a stranger in some offices today.

Let us concede that many, especially women, will not tolerate gold foil in the anterior teeth, and let us admit that some object to the stress of malleting, although this class is not so great as many dentists infer. Nevertheless, there are many cavities that should be filled with foil, that will be neither conspicuous nor work any hardship on the patient or operator. Many small proximal cavities in the upper anterior teeth, and practically all proximal cavities in the lower anterior teeth can be shaped, contoured and finished and will not be conspicuous. Ordinary occlusal cavities in the bicuspids and molars call for foil. Cavities can be prepared with minimum cutting laterally and pulpally, and the insertion and finishing takes but a short time. Structural defects in the lingual and buccal surfaces of upper incisors indicate foil over any other material. Abraded surfaces of the molars that have just penetrated the dentin can be restored to comfort by a shallow filling of foil. The incisors, frequently worn down, exposing dentin and leaving labial enamel liable to fracture must be protected. What other material than foil can be used to advantage? A box cavity of minimum depth, slightly deepened at the mesial and distal extremities, with enamel margins beveled, is filled in a few minutes, and when completed is not distinguishable. There are many incisal angle restorations of foil, gold and platinum that surpass any other restoration for this location. Gingival third cavities in lower incisors, cuspids and bicuspids call for foil. How ridiculous to prepare a shallow cavity in these teeth and cement in a thin veneer of gold! With the rubber dam adjusted, the cavity can be prepared, filled and finished in far less time than an inlay can be made, and I am sure it will prove a better restoration. There are still some indications for the use of foil.

It seems but yesterday, so rapidly does time pass, that Taggart gave us the cast gold inlay. It is true that some men were restoring badly broken down teeth by inlays burnished or swaged to fit the cavity, and the matrix built up with solder or scrap. Those restorations saved many teeth, but it was William D. Taggart who gave us the principles and technic of the modern inlay. How well it has lived up to what he claimed for it, time has fully demonstrated. What a great sphere of usefulness the inlay commands. What a burden it has lifted from the tired shoulders of the dentist, and how it has relieved the endurance and discomfort of patients in the making of extensive restorations. It is especially indicated in large proximoclusal and occlusal cavities, where extensive cusp restoration is necessary. No other restoration is comparable to the inlay for large three-surface cavities. Contour, contact and carving of tooth form are easily accomplished with convenience for operator and patient and without injury to surrounding tissues. For teeth that are drifting from faulty occlusion or because of the extraction of adjoining teeth, extensive restorations are necessary to correct occlusion and restore interproximal space and contact. The inlay is the ideal restoration for this condition. For anterior restorations, the distal cavities in the cuspids can be better restored with a gold inlay than with foil. There are some incisal angles that indicate the inlay. For such a restoration, I prefer the gold and platinum combination, or the inlay with the labial face cut out for the insertion of porcelain or silicate cement.

Gingival third cavities in the molars can, in many cases, be better restored by the inlay than in any other way. Frequently, to make possible the withdrawal of the wax model without distortion, one resorts to excessive cutting of the tooth. This should be avoided by building up the cavity with cement, filling all undercuts, strengthening the walls and protecting the pulp. In many of the deep-seated cavities, we are too apt to think that the thin lining of cement that retains the inlay is sufficient to protect the pulp, but in tapping the inlay into place, fitting it as it should be fitted to all the surrounding walls, the cement is forced into the tooth, as with hydraulic pressure. I think we can all testify as to the number of fatalities to the pulp from this source. I prefer in all my proximoclusal and occlusal inlays to shave a little from the axial and occlusal surfaces of the model to allow for a heavier insulation of cement.

Sharing with foil and the inlay as a preserver of teeth is the amalgam restoration. We must give more consideration and more credit to this material, which fills and, I venture to say, saves more teeth than all other materials combined. Its color and tendency to discolor tooth structure, of course, precludes its use in anterior teeth or on visible surfaces of posterior teeth; but what a field remains. It is not so much a question where to insert it as how to insert it to make it a real permanent restoration. Today, the reputable manufacturer is giving us a standard, dependable alloy. All that remains to make it a good restoration is conscientious treatment by preparing cavities with the same care as we would for foil and inlay, and careful adherence to the technic of mixing and insertion. The mixing cannot be done in the palm in half a minute. At least one minute of vigorous trituration with the pestle in the mortar, and then careful kneading in the hand, are necessary. It should be inserted in small pieces, condensed with medium sized instruments, and with strong hand pressure.

How many amalgam fillings are inserted under the protection of the rubber dam? Only a small percentage; and yet no material in use calls for more strict observance of the necessity for clean, dry walls. Many of the three-surface restorations fail because they are not protected against force until complete crystallization of the material. For such restorations, a carefully fitted band matrix should remain in place until a subsequent sitting. Many proximoclusal amalgam restorations fail to give good service because the cavity has not been properly proportioned, the proximal portion being too great for the occlusal anchorage. In such cases, the cavity should be extended well through the occlusal surface, broadened buccolingually, and made as deep as safety will permit. Ward, in a recent article, advocated the slight grooving of the buccal and lingual walls, from the gingival to the axiopulpal angle, thus securing retention and additional resistance.

Many broken down crowns, hopeless for gold, can be restored to good service by the use of the Blue Island posts and band matrix. In making these amalgam restorations, let us strive to restore as far as possible the anatomy of the tooth, then finish and polish as we would gold. How well they look and how well they serve if only given a square deal!

It is gratifying to note that today we have a few units of skilful men who are giving excellent demonstrations of the proper selection and handling of this material. The editor of *Dental Cosmos*, in his editorial on the decline of operative dentistry, has this to say about a possible means of restoring it to leadership:

As we view the situation, the one greatest hope of the return to leadership of operative dentistry lies in the development of the esthetic phase of dental practice, and this will be solely and inevitably subsequent to the perfection of a safe and sane root-canal procedure, and to the successful development of a means of permanent dental restoration through porcelain or some such material that will adequately meet the growing demand upon dentistry from the esthetic viewpoint.

At present, we have no other material than porcelain that meets these esthetic demands and can be considered a permanent restoration. Many will recall the great wave in favor of porcelain two decades ago, and will remember many of the beautiful restorations made by men of great skill in the clinics of those days. Its popularity did not last because unskilful and careless operators brought it into disrepute. Recently, I saw a patient with twenty-one porcelain restorations inserted twenty-five years ago by the late Joseph W. Wassall of Chicago. There were three proximoclusal restorations that were still good, although some occlusal margins were slightly chipped. The proximal restorations were as fine as the day they were inserted, and not one had even been recemented. It is not possible for all to possess the skill of a Wassall, but it is possible, with the improved bodies, improved furnaces and the present facilities in teaching and technic, to develop sufficient skill to make a good porcelain restoration where it is indicated. If gold foil is to be taboo for anterior teeth, we must turn to porcelain for gingival thirds, simple proximal and many incisal angle restorations. No material is as compatible with the soft tissue as porcelain.

Of all the materials ever used for permanent tooth restoration, the least dependable are the silicious cements, alias "synthetic porcelain." Their principal claim for recognition is harmony of color. In some mouths, they do hold the color well; but, in a large percentage, the color soon changes, showing a discoloration that is far more unsightly than that of foil. I have yet to see any that retain contour and contact. The material is so porous that it absorbs moisture and disintegrates around the contact surfaces, and it does not adhere consistently to all walls of the cavity. One of the specific instructions of the manufacturers is to undercut all surrounding walls for retention. I find, in replacing these fillings, that it is usually necessary to enlarge the cavity because of discoloration and recurrence of decay. Silicious cements possess another serious fault, causing irritation and death of the pulp. Some who use this material extensively declare they have had no such experience. One writer states that the only precaution which he takes to safeguard the pulp is to flood the cavity with phenol and wipe to comparative dryness. My experience has not been so satisfactory. I do not believe that any cavity, no matter how shallow, should be filled with this material without first protecting the pulp; and some of the varnishes are not sufficient protection. I prefer, in most cases, to make the cavity a little deeper, and place a thin layer of oxyphosphate over the axial wall. The use of this material is increasing daily, and no one seems to be making a clinical study of its action. We are all satisfied to take our instructions from the manufacturer's laboratory, and we know there is a great difference between laboratory and clinical tests and results. There is no doubt that the silicious cement is here to stay. The incessant demands from our patients cannot be ignored. It has a limited place in operative procedures, but it is being used much more extensively than its merits warrant.

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Editorials

CHILDREN'S DENTISTRY

The outstanding thing of significance on the dental horizon today is the care of children's teeth. Not the mere routine and desultory care given children under emergency of pain as is done in many offices, but a systematized and concrete service with the definite object of establishing in the mouth of every child an early condition of immunity, with the consequent result of bringing children to adult life and even to old age with a good, healthy, serviceable set of natural teeth.

If every member of the profession could be roused at this time to the opportunity presented by this service to children as a medium of placing dental practice on a higher plane of achievement, it would change the whole aspect of dentistry as a professional pursuit and constitute it more definitely an integral factor in the maintenance of the health of the people.

Child dentistry can solve most of the problems of the profession. It can prevent the hideous deformities that mar the mouths of many of our people; it can minimize or even prevent most of the suffering from diseased teeth; it can add to the longevity of the people and make them more efficient, more comfortable and more beautiful. It is the one concrete service today by which we can minister to humanity in a definite and tangible way minus the experimentation and uncertainty which enter into some of our adult work at the present time. It can prevent distortion of the features and the handicap of hampered speech. It can mold the human countenance into lines of grace and beauty, and give growing children a fairer chance in life to meet the emergencies and necessities of our modern civilization. It can settle once and forever the mooted question of the pulpless tooth, and clear the fog with which it has been clouded in recent years.

Why the profession has not recognized these things earlier in its history is beyond conjecture, for they have all been demonstrated repeatedly. In recent years, there is a very encouraging awakening on the subject, and we may confidently look forward in the next decade to a changed attitude on the part of the profession.

The first organized effort on behalf of children's dentistry was a resolution passed by the Massachusetts Dental Hygiene Council in March, 1926, to the effect that "the only hope of real progress lies in the prevention or early control of dental disease," and that, to accomplish this, attention must be given to the teeth of young children. The resolution in its entirety was copied and adopted by most of the dental societies of this country, and as far as organized dentistry is concerned, it is amply on record as favoring the early care of children's teeth.

But resolutions are not enough. It is all very well to pass resolutions, but what is of greater importance is the actual carrying out of child dentistry in the offices of the land. It is what every man does in his practice that really counts, and it is no longer a collective matter but an individual one. Dentists have too frequently hedged on the practice of child dentistry, and have shirked

their responsibility by promulgating the theory that deciduous teeth did not call for attention on the ground that they were soon to be lost and were therefore not worthy of consideration. This seed planted in the minds of parents has done untold injury, and no dentist can afford to preach that doctrine today. In the dental educational campaign that is going on all over the country, people are told, and properly so, that the care of children's teeth—even their deciduous teeth—is most important, and when the intelligence of the people is raised to the point of conviction on this subject they will demand that their children be cared for. When this time comes, as come it will, the dentist who shirks his duty in this regard will be heralded as a practitioner unworthy the confidence and esteem of the people, and will soon find himself outside the fold of recognized dentistry.

It is a homely phrase to speak of the necessity of people getting in the band wagon of progress, but in this instance it is a very pat phrase, and no dentist can afford to ignore it. Unless a practitioner recognizes the essential importance of child dentistry, and lives up to its demands, he must expect to be relegated to the rear ranks, for the reason that, in the near future, not only the profession but also the people will recognize the significance of this service, and will demand that it be delivered in full measure as an integral part of every man's dental practice. The profession must keep faith with the people, or ultimately the people will refuse to place confidence in the profession.

THE 1928 MEETING

The coming meeting of the American Dental Association at Minneapolis, August 20 to 24, promises to be one of the best ever held. Everything seems favorable for a record-breaking attendance. Although the time between the Detroit and Minneapolis meetings is shorter than that usually intervening between annual meetings, the energy displayed by the officers and chairmen of committees has been such that the lessened time has seemed to act as a spur to

greater and better achievement. It is frequently the case that when time is limited for a given problem, the concentration of effort more than compensates for limitation of time, and the net result is a more creditable piece of work accomplished with greater expedition.

This at least seems true of the preparation for the 1928 meeting. A mere glance at the program will indicate the character of the material being prepared for those in attendance. It would seem that every taste and every need had been considered, and he who cannot find something of vital interest in the list of papers and clinics is indeed hard to please.

The President, Dr. Volland, has devoted his time and energy in unsparing measure to further the interest of the meeting and to conserve the welfare of the organization. He has traveled almost constantly since the Detroit meeting and has held himself in readiness in season and out in his service to the organization. The Secretary, Dr. Pinney, has approached a new field of service wholeheartedly and efficiently, and has shown a most encouraging grasp of the needs of the Association as applied to the coming meeting. The members owe it to these officers to rally around them in loyal fashion and work to a man for the success of the coming event.

Another important factor in the promising outlook is the splendid work done by the Local Arrangements Committee. A more earnest body of men never got together for a given piece of work, and the thanks of the entire organization are due them for their sacrifice of time and effort. It is no small task to stage a meeting of the magnitude of our annual event, and every man who contributes in as concrete a way as the members of the Local Committee have done is entitled to more than ordinary credit. Minneapolis is admittedly an ideal place for such an event, and we may all look forward to not only a profitable but also a comfortable time.

Our meetings seem to grow in interest each year, and this one promises to outstrip its predecessors. Get ready for Minneapolis in August.

THE IDEALIST

The idealist is a man who clothes the tree of life with the glory of color and form. He covers the bare and naked branches of reality with the soft-hued foliage of leaf and flower. He plants a rose and seeks to enlist the wizardry of nature till he has it free from thorns. He sees the sunshine behind the shower, and he even turns the shower into a beneficent cooling of the heated earth.

He finds the silver lining where others see only the somber cloud. He smiles when others frown—he hopes when others despair. He takes the world on faith; and then by force of his own cheer, he makes the world keep that faith.

He turns the hideous incongruity of calamity into the beneficence and beauty of a blessing, and then transcribes the lesson thus learned for the sons of men to read. He plants a blossom where a brier had grown—a germ of grain where a weed had encumbered the earth. He sees the good in every human heart, and nurtures it with the vivifying force of his own life.

He takes the darkest day and illumines it with the light of his own radiance. He creates sunshine when the sun forgets to shine, and sees the rays of light through the javelins of falling rain.

He pours the oil of charity over the troubled waters of sin and shame, and washes clean the smirch on the name of an absent friend.

Without idealism, the world would be prosaic and practical. Too much practicality tends to sordidness, and no sordid individual or nation ever achieved greatness. Idealism softens the harsh and rugged outlines of the horizon of life, and casts the glorious glow of the rising sun over the landscape or the rippling waves.

Idealism takes out of a tired day the weariness and grief, and soothes the pillow at night for the aching heads of men. It eases the stress and strain of strife, and quiets the tempest of contention. It unravels the baneful snarl of misunderstanding, and throws the light of perfect faith over the doubts and dreads of life. It humanizes and harmonizes the motives and acts of men, and changes the

hatreds and heartaches of humanity to the blessed balm of peace.

Idealism is the rainbow of the past and the promise of the present. It is one among the beneficent means by which the world is to be regenerated, and the hearts of men made glad. Idealism is the savior and benefactor of the race, and the rarest star in the firmament of the future.

ARTHUR R. MELENDY

In recent months, the dental profession has been called on to mourn the loss of some of its most illustrious members. On May 22, Arthur R. Melendy, of Knoxville, Tenn., passed away, and his death brings to the American Dental Association a very intimate sense of loss from the fact that it takes one of our official family. Dr. Melendy had been Treasurer since 1914, and in this important capacity he had rendered signal service to the organization. It will not be easy to fill his place with a man of like qualifications, and yet he was so systematic and painstaking in his methods that his successor will find his way made easy for him by following in the late Treasurer's footsteps.

Dr. Melendy was a man of the most sterling worth. He was calm, judicial, tolerant, faithful, charitable, and astonishingly well poised. For years, he had been a tower of strength to the Association, and his annual reports were marked by clarity and exactness. During the time when Dr. Melendy was at the helm of our finances, there was always a sense of security on the part of the members and a feeling that the funds would be carefully conserved.

He was known to many of our members personally, and was universally beloved. His geniality and perfect candor won for him the respect and affection of a wide circle of friends, and his innate modesty bound men to him in confidence and esteem.

Dr. Melendy was without envy of his fellowmen. If others received honors he rejoiced; if honors came to him—which they did in plentiful measure—he accepted them with hesitation, with wonder and with gratitude. He was President of the American

Dental Association in 1911-1912, and had held nearly all the offices in the gift of his profession.

The passing of Dr. Melendy removes from the Association and the profession one of the most worthy, reliable and lovable men in our ranks. We have been favored by having his service and his association so long; and now that he is gone, it is a pleasure to give expression to our appreciation of his many admirable qualities of mind and heart, and to record our gratitude that we were privileged for so extended a time to receive the benefit of his rare judgment, and to bask in the sunlight of his genial personality.

ARTHUR RICE MELENDY, D.D.S.

(1859-1928)

By CLAUDE R. WOOD, D.D.S., Knoxville, Tenn.

The long and useful career of Arthur Rice Melendy, treasurer of the American Dental Association, came to a peaceful close at his residence, 1628 Yale Avenue, Knoxville, Tenn., at 5 p. m., Tuesday, May 22, 1928, his death being due to chronic interstitial nephritis, which was the probable result of three separate attacks of pneumonia in 1925 and 1926. He was buried in Old Gray Cemetery, Knoxville, Tenn., Thursday, May 24.

Dr. Melendy was born near Brattlesboro, Vt., March 4, 1859, his parents having come from the north of England. He removed with his parents to Rogersville, Hawkins Co., Tenn., in 1869, and spent his youth there, receiving his education in the public schools and McMinn Academy in his home town, and later attending the University of Tennessee in Knoxville.

He received his professional education in the Dental Department of Vanderbilt University, Nashville, and, on leaving there, began the practice of dentistry in association with S. B. Cook, Sweetwater, Tenn., in 1883, both of them doing much itinerant practice. He removed to Knoxville in 1890, and remained in continual practice until his retirement, in the spring of 1927, because of failing health.

He was married in Sweetwater in 1884 to Miss Vallie Brewster, who died in 1893. To this union was born one son, Mellville B. Melendy. He was again married, to Miss Mabelle E. Hudson, in Knoxville in March, 1908. To this union was born one son, Arthur H. Melendy. He is survived by his widow and both sons.

Few men in the profession have been so signally honored by his confrères as was Dr. Melendy. He was President of the Tennessee State Dental Association in 1901; President of the Southern Branch of the National Dental Association in 1908, having served several years as chairman of the Executive Committee; Treasurer of the National Dental Association, 1905 to 1911, and President of the National Dental Association, 1912. He was again elected Treasurer of the National Dental Associa-

tion, in February, 1915, for the unexpired term of the late H. B. McFadden. He was reelected and continued to serve as Treasurer of the American Dental Association until his death.

During these years, he served on many committees and commissions, being a member of the National Educational Council and of the Scientific Foundation and Research Commission of the American Dental Association. He was a delegate to the Fifth International Dental Congress in Berlin in 1909, and to the Sixth International Congress in London in 1914. He was very active in the work of the associations to which he belonged, and notwithstanding his many duties in connection with the parent association, his interest in his state association and his local society never slackened. In the fall of 1927, his local society, the Second District of Tennessee, presented him with an engraved testimonial as a token of appreciation of the meritorious services rendered this society.

In his connection with association work and in every other walk in life, he was known for his prudence, caution and justice. He was always kind and gentle whatever the circumstances might be, and seemed to have a peculiar faculty for reconciling conflicting interests and bringing harmony out of discord.

He was a member of the Delta Sigma Delta Fraternity, Supreme Chapter, a Scottish Rite Mason and Shriner, holding membership in Trinity Consistory, Nashville, in Oriental Lodge and Kerbela Temple, Knoxville. Notwithstanding his various activities and interest, his skill and conscientious methods commanded a large and lucrative practice from the beginning, and as an all round practitioner he had few equals.

Dr. Melendy, among his friends and neighbors with whom he was in constant association for a period of forty years, was best known as a quiet, retiring and consistent man of God. He had been a member of the Presbyterian Church for forty-eight years, for thirty-eight of which he was a member of and a ruling elder in the First Presbyterian Church of Knoxville. For about twenty years, he was superintendent of the Sunday school, and of late years, one of his most loved interests was an adult Bible class in the school.

His was a firm belief in the Bible as the inspired and inerrant word of God, a faith rooted and grounded in the eternal verities, woven into the fiber of every motive, thought and act of his being, and expressed in a life which proved a blessing and an inspiration to all about him. Gentle, kind and loving, his home life was ideal and to the loved ones bereft, there remains a heritage rich in memories of a truly good husband, father and citizen.

"For I know whom I have believed and am persuaded that he is able to keep that which I have committed unto him against that day."

BUREAU OF DENTAL HEALTH EDUCATION

DIET IN RELATION TO SKELETAL DEVELOPMENT IN CHILDHOOD*

By JULIUS H. HESS, M. D., Chicago, Ill.

IN discussing diet for children, I shall take the liberty of reviewing the results of deficient feeding and the effects of faulty metabolism on development, rather than to limit myself to the more specific detail of diets. Such a discussion must largely concern itself with malnutrition and the so-called deficiency diseases in their various phases as encountered in childhood.

It is clear that any effective program for bettering the nutrition of childhood should stress prevention rather than cure. The high percentage of poorly nourished children in our schools will never be permanently reduced until we provide every essential for optimum nutrition continuously throughout fetal life and the entire growth period.

PRENATAL CARE

Nutritional care must start, not with the advent of the child into the world, but with the very beginning of its life. Many of the popular beliefs and theories regarding a pregnant woman's dietary are as amusing as they are erroneous and unfounded. There need not be any great divergence from the usual varied diet, but only a closer attention to the completeness of it. Sufficient food should be taken by the mother to meet the requirements of her own body and, at the same time, to furnish materials for nourishing the developing embryo. If her consumption of food falls below this minimum, the reserve energy of the mother's body must make up the deficiency, with an inevitable loss of weight in the mother and poor skeletal development in the child.

It is universally agreed that the diet of the expectant mother should be digestible and of sufficient caloric value. It should contain ample amounts of fat, protein and carbohydrate, selected from foods rich in vitamins and, equally important, of high mineral content. A diet so constructed will have a favorable influence on mineral retention, which is of paramount importance in the development of fetal structures.

Greenebaum and his fellow-workers[1] studied the effects of actively regulated diets of pregnant women on the development of rickets in their offspring. The methods of study were as follows: Twenty-five pregnant women who previously had given birth to rachitic children

*Read before the Section on Mouth Hygiene and Children's Dentistry at the Midwinter Clinic of the Chicago Dental Society, Jan. 24, 1928.

1. Greenebaum, J. V.; Selkirk, T. K.; Otis, F. A., and Mitchell, A. G.: Effects of Diet During Pregnancy on Development of Rickets in the Offspring, J. A. M. A., 87: 1973-1976 (Dec. 11) 1926.

were furnished with special diets during the last three months of their pregnancy. These women were studied in two groups in order to include both winter and summer seasons. Only mothers apparently physically normal and promising to cooperate were chosen. Funds were provided in amounts sufficiently large so that the dietitians were in no way limited in obtaining food correct in quality and quantity for these women. A similar number of control cases were studied in the same manner.

At the end of the observation period of several weeks on the previous, unregulated diets, the experimental or supervision period began, continuing approximately throughout the last three months of pregnancy. During this time, the mothers' diets were supplemented by vegetables, cereals, fruit, eggs and milk (all of which were furnished free of expense to the mothers), the endeavor being to bring the daily food intake up to the proper standard for pregnant women. The standard sought was the daily ingestion of food containing 1 gm. of calcium, 1.45 gm. of phosphorus and 0.015 gm. of iron, and having the equivalent of 2,500 calories.

After delivery, when active supervision ceased and additional food was no longer supplied, mothers, with but one or two exceptions, returned to the dietary habits of the pre-experimental period. Therefore, the only factor known to be modified in this study was the mothers' diet in the latter months of pregnancy.

From observations, it was concluded that proper balancing of caloric and mineral intake in the diet of the expectant mother during the last three months of pregnancy, while it will not prevent postnatal development of rickets, will have a controlling influence on the development of the disease during infancy. After birth and during the breast-feeding period, the diets of both the mothers on the special diet and those in the control group were approximately of the same quality. During the bottle-feeding period, all of the babies visited the Infant Welfare Clinic, until their ninth month of life. No mother in the special group of cases whose intake was above 1,700 calories composed of a well balanced diet gave birth to an infant who showed more than mild rickets at any time by either clinical or roentgen-ray examination. In the control group in which the prenatal diets were left to the mothers' discretion, more severe forms of rickets developed in the infants. This was especially true in the case of mothers whose diets were under 1,500 calories daily during the later months of pregnancy. Hess and Weinstock,[2] in a similar study, state, "a consideration of the experimental evidence, of clinical tests, of the susceptibility of bottle-fed compared to breast-fed babies, and the striking seasonal incidence leads to the conclusion that rickets is mainly of postnatal origin. Although its incidence and severity may be influenced by improving the nutrition of the mother."

In his study of the ash content of the human fetus, Birk[3] found that a 4-months fetus contained 14 gm. of ash; at 6 months, 30 gm.; at 9 months, 100 gm., showing that two-thirds of the mineral content developed during the last three months of fetal life. In the new born, fully 75 per cent of this ash is made up of calicum and phosphate, the chief constituents of the bones.

2. Hess, A. F., and Weinstock, M.: Rickets as Influenced by the Diet of the Mother During Pregnancy and Lactation, J. A. M. A., 83:1845 (Dec. 6) 1924.

3. Monatschr. f. Kinderh., 1: 644, 1910.

The importance of a well-balanced diet as well as good health on the part of the mother, in its relationship to every phase of fetal development, is strikingly evident.

FEEDING DURING THE PERIOD OF INFANCY

It is to be emphasized that there is no perfect substitute for human milk in the feeding of the infant. All endeavors made to feed an infant on a food not primarily intended for this purpose must be considered as trials at milk adaptation. No single diet can possibly meet the needs of all infants.

Infants at birth may be classified for purposes of feeding into two groups. The first will include those prematurely born and weaklings and the second, normal, full-term babies.

PREMATURE INFANTS

In a review of my experiences in feeding premature infants, covering a group of 415 cases cared for during the past six years in the Premature Infant Station of Michael Reese Hospital, I am convinced that human milk as compared with cow's milk feeding gave far better results both as to morbidity and mortality when the infants received breast milk during their first weeks of life.

In addition to breast milk, the feeding of orange juice is instituted by the third week, beginning with 0.5 c.c. and increased to 2 to 4 c.c. daily by the eighth week. Cod-liver oil as an antirachitic should be fed by the fourth week, beginning with 0.5 c.c. daily and increased to 2 c.c. daily by the eighth week. To counteract the low iron content of the diet, we add raw egg yolk to the breast feedings and cow's milk feedings.

Exposure to the quartz light is given daily as early as the third week, the time of exposure being dependent on the individual infant, beginning with one-half minute at 100 cm. distance.

While many of the infants show a minor, and a few a moderate, degree of rickets, only a small number have developed marked manifestations. We believe that this is due to the fact that cod-liver oil and quartz light therapy were introduced when the infants were 2 or 3 weeks of age. We have not had any cases of rickets in which mechanical appliances or surgical intervention were necessary to correct deformities. Active signs of tetany did not develop in any of the infants of our series.

Teething has been delayed, as would be expected. However, nineteen of our infants had one or more teeth during the seventh month. As a group, by the eighteenth to the twenty-fourth month, they closely resembled full-term infants in physical and in mental development. There are no apparent mental defectives in our series. Nature has wisely removed those not fitted to survive.

The results of my study of skeletal development as evidenced by roentgenograms covering a series of fifty-five fetuses may be of sufficient interest to bear quoting, because they prove the importance of instituting a proper regime of diet and hygiene during early pregnancy, if normal development is to be assured.

I shall confine my discussion at this time to the centers as seen in the skeleton of the head. One center in each half of the mandible was visible in most instances by the end of the seventh week of fetal life. The only other centers visible at this early period were the clavicles, which occasionally appeared as early as the sixth week.

During the eighth week, the squamous portion of the occipital bone and the superior maxilla became visible. In the latter, ossification begins soon after that of the mandible, the center appearing above the region where the alveolus of the incisor tooth is later located.

During the ninth week, the following additional centers of ossification are visible in the head: inner lamella of the pterygoid process of sphenoid and mastoid portions of the temporal bone. The zygomatic process of the temporal bone begins to cast a shadow. The superior maxilla forms at this time a simple triangular plate, the base of which is parallel to the margin of the maxilla, the apex pointing toward the root of the nose.

In the tenth week, comparatively few new centers of ossification are added. In the skeleton of the head, the nasal bone and frontal bone show centers of ossification. The great wing of the sphenoid becomes visible.

From the eleventh to the twelfth week, the tympanic ring usually becomes visible, rarely at the end of the eleventh week. The median lamella of the pterygoid process reaches considerable size and is visible as a hook-shaped, curved plate with concavity posteriorly, lying behind the lower portion of the perpendicular part of the palate bone. The malar bone joins the end of the zygomatic process of the superior maxilla and that of the temporal bone. Four centers are now present in the occipital bone. The anterior sphenoidal body begins to ossify.

From the thirteenth to the sixteenth week, the lesser wing of the sphenoid becomes visible. The posterior body of the sphenoid appears about the fourteenth week.

From the seventeeth to the twentieth week, several new centers of ossification appear in the petrous portion of the temporal bone, but they do not show well in roentgenograms. The bony labyrinth begins its development. In the rudiments of milk teeth, bone tissue begins to be formed and casts a shadow. The process starts in the lower incisors.

From the twenty-first to the twenty-fourth week, the superior maxilla shows a large amount of spongiosa. Toward the twenty-fourth week, the alveolar portion of the superior maxilla begins to overhang the level of the palatal plate, but develops as a real process only during the cutting of the teeth.

From the twenty-fifth to the twenty-eighth week, the rudiments of all the deciduous teeth have entered the stage of ossification in this mouth.

ARTIFICIAL FEEDING OF INFANTS; COW'S MILK MIXTURES

It must be our object, first, to formulate feeding orders that will be safe and adaptable to the feeding of the majority of well babies. Even so, the foods recommended will be excessive for some and inadequate for others.

The successful physician must depend on the clinical observation of the individual infant for the success of the method of feeding which he is using. Every formula with which we start feeding should be looked on in the light of an experiment, and the reaction of the infant to this feeding should be studied carefully.

The wide range of tolerance of infants to their foods in all probability accounts to a great degree for the fact that so many men have been successful in the feeding of infants on a variety of mixtures which varied greatly, both quantitatively and qualitatively. There

is, in all probability, another factor which is important in explaining these successes; namely, the fact that, to a certain extent, fat, carbohydrate and protein are interchangeable in their metabolic functions.

If milk dilutions, with the addition of carbohydrates, are used, we should know the number of grams of proteins, fats, carbohydrates and salts the infant is receiving for each pound or kilogram of its body weight.

Milk Required.—To meet protein, fat and salt requirements in feeding with diluted whole milk, the average normal infant will require each day from 1½ to 2 ounces per pound or from 100 to 130 c.c. per kilogram of body weight, exclusive of the sugar and starch which are added in preparation of the mixture.

Water to Be Added.—Young infants will require one-fifth of their body weight in fluids daily, 3 ounces per pound (200 c.c. per kilogram). These amounts may be gradually decreased until, in the last months of their first year, one-eighth of their body weight, 2 ounces per pound (130 c.c. per kilogram), will suffice. The amount of water to be added to the mixture will therefore be governed by the amount of milk in the mixture, the number of feedings and their amount. Water may be given between feedings to complete their fluid requirements.

Carbohydrates to Be Added.—Having the necessary amount of milk and water, we ascertain the carbohydrate to be added. Normal full weight infants will usually require a minimum addition of one-tenth ounce of sugar to the milk mixtures for each pound of body weight (6.6 gm. per kilogram); 1½ ounces of sugar per day fulfils the maximum requirements for most infants. For underweight infants, as with the milk, the amount should be calculated at first on the basis of their present weight, but increased if well taken, to coincide with the amount indicated for a full-weight infant of similar age. Cane sugar answers our requirements for most cases. Milk sugar acts as a laxative in many infants. Unless the laxative effect is desirable, it has no advantages. Maltose and dextrin compounds are of practical value when large amounts of cane or milk sugar are not well taken. Because of their varying maltose, dextrin and alkali content, some are constipating and others are laxative. This must be given due consideration in their selection.

Breaking the Curd to Assist Digestion of Cow's Milk.—In my own practice, all milk feedings are boiled. Orange juice or acidified milk, such as lactic acid milk, precipitate with a fine curd.

Orange Juice, Egg Yolk Milk Mixtures.[4]—The milk, water and sugar mixtures just described, while furnishing an optimum of fat, protein, carbohydrate and salts other than iron, are low in vitamins. During the past two years, I have been conducting a series of experiments in our laboratory, as well as in animals and infants, on the effects of adding orange juice and raw egg yolk to our milk mixtures. It is readily seen that such mixtures supply all of the ingredients needed for the infant's growth and development and are especially rich in vitamins A, B and C and the antirachitic element. The egg yolk also supplies a considerable amount of iron. The stools become yellow and are much more plastic than when ordinary

4. Hess, J. H.: Feeding and the Nutritional Disorders of Infancy and Childhood, Ed. 5, Philadelphia: F. A. Davis Co., 1927.

milk mixtures are taken. The hemoglobin curve shows improvement.

Further advantages of such a mixture are that its buffer value is lowered by the orange juice, which gives it an average p^H of 6. This conserves the gastric hydrochloric acid. The proteins are partly denaturized by the boiling and the addition of the fruit juice, and again the curds formed in the stomarch are finely divided. Our clinical experience with the orange juice-egg yolk mixtures now approximates about 1,500 cases in infants.

In practice, we usually prescribe milk which has been heated in a double boiler, exceptions being in the case of infants who vomit and those who have gastric dilatation and in whom small concentrated feedings are indicated. For these, we boil the milk in a single boiler for from three to five minutes.

Orange juice can be given as early as the second or third week of life. One ounce of orange juice is added for every pint of milk in the mixture; in other words, a mixture containing a pint of milk and a pint of water would have 1 ounce of orange juice added. Exception is made to this in beginning feedings for very young infants. For them, half the amount of orange juice is added during the first days after institution of this mixture. Occasionally, an infant who received the full amount will show some increased flatulence and looseness of the bowels, more especially when very sour oranges are used. In such cases, it may be reduced to one-half ounce to the pint of milk.

The raw egg yolk in our milk mixtures is started with about one-eighth (½ teaspoonful) of the yolk of a raw egg by the time the infant is 3 or 4 weeks of age and increased in amount to a whole yolk by the end of the fourth month of life.

Both the orange juice and the egg yolk are added after the milk has been boiled and cooled. They are simply stirred and not beaten into the milk.

Cod-liver oil can advisedly be continued as a part of the diet throughout all seasons of the year. Sunshine should be considered as a part of the daily ration. Cooked cereals should be added to the diet when the infant is 4 months old, and vegetable soup at 6 months.

An occasional infant will present special conditions, among others diarrheal disturbances and tetany, which may be benefited by the acid milks which have a still lower p^H. Among the most valuable are lactic acid and protein milks. Each of these can be prepared from fresh milk or can be purchased in the dried forms.

Recent experiments by A. F. Hess[5] and Steenbock[6] in irradiation of foods by exposure to ultraviolet light have stimulated an almost universal interest on the part of the profession and food manufacturers. We now have positive evidence that both fresh and dried foods can be activated to such an extent as to stimulate healing of rickets, as evidenced by an increased retention of calcium and phosphorus in the blood and changes in the roentgenologic picture.

The degree of permanence with which food products remain active is as yet unknown. It is to be hoped that food manufacturers may be sufficiently conservative in their claims. Recent experiments by Wyman[7] showed that a two-hour exposure of cod-liver oil to

5. Hess, A. F., and Weinstock, M.: J. A. M. A., 83: 1845 (Dec.) 1924.

6. Steenbock and Daniels, J. A. M. A., 84:1093 (April 11) 1925.

7. Wyman, E. T., and co-workers: Am. J. Dis. Child., 34:753 (Nov.) 1927.

ultraviolet rays from the quartz lamp decreases its antirachitic activity and that a thirty-minute exposure did not enhance its value. The value of shorter exposure is still problematic.

PRESCHOOL AGE CARE

To have brought a child through the prenatal period and the first two years of life and to have continually maintained good nutrition is a real achievement. It means that the child has been given the finest start that he could have for his after-life.

But this is a start only, not the end of the journey, as parents often appear to regard it, if one may judge by the sudden or gradual let-down that is wont to occur about this time. The same necessity for a simple though somewhat extended diet of milk, cereals, eggs, vegetables and fruits exists. There is the same demand for long hours of sleep, a regular, early bedtime, and a daytime rest; for fresh air, sunshine, and wholesome but not excessive exercises, and for a generally well-ordered life. Then, too, this is the most important period in habit formation. Habits of liking and eating a fairly large variety of the simple and wholesome foods of which the child's diet should be largely composed, and of eating what is set before him as a matter of course; habits of regularity in sleeping, in eating, in evacuations, as well as habits of obedience, of cheerfulness, of self-reliance, and a host of others less directly concerned with his physical well-being, should be developed during this preschool period.

SCHOOL AGE CARE

A continuance of the same adequate diet and health régime, with suitable modifications for the increasing age, together with a reinforcement of the home program by the health-education activities of the school, should carry these children through school and into adult life as a group of well-nourished, physically fit individuals. The dangers which beset this period—the inadequate breakfasts and lunches, the hurried meals, the candy habit, the late hours, overexercise, and overstimulation, which have been mentioned—must be recognized by both parents and school, and cooperative efforts must be made to prevent them.

Appetite and the Psychology of Proper Eating.—In attempting to develop each child to his own maximum of physical perfection and to help him to secure a stable nervous system, the eating problem plays no minor rôle. Most children have extremely strong wills and, after their appetites have been spoiled, cannot be forced to eat enough food to maintain their best nutrition. In some children, this is the result of mismanagement; in others, it is a true anorexia nervosa. Hardly a day passes in the clinic or office without our seeing a malnourished child, generally between the twelfth month and four year of life, who persists in the refusal of an adequate amount of food or voluntarily restricts himself to a poorly balanced ration. There is the usual statement from the mother, less often from the nurse, that at each meal for a number of weeks or months has been a battle royal to force food on the reluctant child, not only at the regular meal hour but between meals as well. In spite of this well-meant effort, the child is eating less rather than more, and there has been a stationary weight for a long period or persistent loss of weight.

The treatment of such a child begins with the education of the mother or nurse. Sufficient time must be taken to impress on the mother the value of a different type of management. She must

be made to acquire some conception of the psychology of childhood, especially the tendency of many children to negativism, and the aggravation of this symptom by faulty management must be explained to her.

We have seen many mothers in our dispensary clientele who had become dissatisfied with the weight of their children after comparing notes with friends and neighbors. Their logic had pointed to a greater food intake to accomplish the desired weight increment. Since the average child will take only enough to satisfy his appetite, the habit of urging and stuffing the child at each meal was the inevitable result. It is no wonder that children protect themselves against such assaults by vomiting.

It does not require much knowledge of the behavior of children to appreciate that the conduct of a child is largely determined by the example, the personal influence and the suggestions of those most closely in contact with him. Indirectly, such influences interfere with the digestive capacity of the child.

PROPER EATING

Meals at Regular Hours.—The meal hour should not be left to chance. The child should be given his meal on time even though there may be an occasion for delaying the family meal. Every child should spend at least twenty minutes, according to the clock, at his meals.

From supper until breakfast is the longest time that the stomach is without food in the twenty-four hours; therefore, every child should be hungry for his breakfast. If he is not, there is something wrong.

Developing Tastes for Food.—Almost every child can be taught to like food that he ought to have, and his taste for the right kind of food can be slowly developed. It is best to do this while he is young, giving him the right food at the start, so that he has no chance to get wrong eating habits. Do not force a child to eat. A child should be taught to eat what is good for him, but when he has no appetite, is overtired and worried and refuses to eat, he should not be forced to eat. If a child has no desire to eat day after day, there is something wrong with him, and the first and most important step is to find out at once why he is not hungry.

Food should not be given between meals if it is refused at mealtime. Neither should a child be tempted with unsuitable foods when he refuses the ordinary foods.

OVERFATIGUE

Overtiredness is a very common cause of malnutrition. In children suffering from fatigue, not only are the muscles tired but the digestive organs as well. Parents do not realize the utter fatigue of the malnourished child in his struggle to meet present-day standards that are often too high even for the well. A special program which provides for his needs should be made for him.

The school program is often too intense for undernourished children. With music lessons, dancing, boys' and girls' clubs, heavy school work and much homework, they are often up too late at night and their bodies are too tired to make use of the nourishment in their food. The stress of present-day life has added to the burden of growing children. If they fall behind or fail in their classes, they are called lazy, and more pressure is put on them at home and in school. The study hours are made longer and the home-work is increased. A vicious cycle is thus established, which means that malnutrition makes them

more tired and being too tired adds to their malnutrition. Thus, because of the ignorance of parents and teachers, these children may grow up into misfits, failures and physical and nervous wrecks, who make life miserable for themselves and for others.

POSTURE

Children who stand and sit straight are more apt to be healthy because the organs of the body are held in the right position to do their work. Training in good posture should start not later than the fourth year. Much can be accomplished even during infancy by well regulated massage exercises.

Children often take wrong postures, especially while reading, writing or resting at their desks. Poor eyesight is a common cause of bad posture. Sleeping positions, like those of standing and sitting, should be varied.

The slender, lanky, rather high-strung child is most apt to have faulty posture. He should learn early to carry his body properly. To aid such a child in acquiring the posture and strength needed in life requires much patience and skill.

Correcting Wrong Posture.—To correct posture, a few simple exercises should be practiced each day. The muscles and ligaments can thus be trained to hold the framework and organs of the body in the right position. This may not overcome the trouble entirely but will be a help to the child in getting back to normal.

DEFICIENCY DISEASES

Custom has sanctioned the use of the term deficiency diseases to describe scurvy, beriberi and xerophthalmia. Many authors would include under this term also rickets, war or famine edema, pellagra, stomatitis and such intestinal conditions as mucous colitis and intestinal ulcerations.

The time has come to sound a warning against attributing every pathologic state which appears during periods of deficient feeding to insufficient intake of vitamins or even to bad diet alone. We are but just now beginning to be able to analyze diets, and many which were a few years ago considered adequate except for one factor now appear to have a deficit in several factors. It is probably true that vitamin deficiency plays a part in the production of certain states of malnutrition in man, but it is equally true that single deficiencies in the diet of human beings are seldom found. Deficiency diseases in man usually have a complex etiology, and the dietary defects which produce them are often not alone the lack of vitamins. They are almost always complicated by the effects of feeding low or incomplete protein and, not infrequently, improper amounts of carbohydrates and salts. As regards the salts, not only are they essential but they must also be present in proper proportions, as evidenced by the development of rickets when either calcium or phosphorus are insufficient. We know that animals are enabled to compensate for faulty calcium-phosphorus ratios in the diet if they are exposed to the rays of the sun or the iron-chromium or cadmium arcs or to the light of the mercury vapor quartz lamp. It is difficult to say, in many cases, at what point the effects of defective food and lack of sunshine are complicated by secondary effects of impaired function on the part of the parenchymatous organs, more especially the digestive and endocrine glands; also, by the invasion of the weakened tissue by pathogenic microorganisms.

All of the conditions grouped under the term "deficiency diseases" must be

acknowledged as systemic diseases involving all body tissues without selective action, even though the clinical signs are most strikingly manifest in certain organs or tissues.

In practice, we of the dental and medical professions have learned to respect the after-effects of this group of diseases. Unfortunately, they do not lose their importance with their retrogression, which, in the cases of rickets and scurvy, is in late infancy. In many instances, the tissue changes impair organic functions to such an extent that they leave their impressions throughout life.

In conclusion, I wish to emphasize that prophylactic feeding and hygiene, available though they may be, are often difficult to apply, and education of the laity must be the watchword.

THE HOME CARE OF THE MOUTH*

(Compiled by The American Academy of Periodontology, 1928)

The purpose of the personal home care of the mouth is to aid in protecting the teeth from dental decay; to preserve and promote the health of the tissues which support the teeth in the jaws, and to provide a clean environment for the masticating machine and also for the food which is prepared for digestion in the oral cavity.

The dentist usually cannot prevent the loss of the teeth, even with the most skilful efforts, unless he is assisted by the patient with thorough home care of the mouth. The efforts of the patient are largely preventive, while those of the dentist are more often restorative.

THE FOUNDATION OF THE TEETH AS IMPORTANT AS THE TEETH

Many teeth having no cavities, and in perfect condition otherwise, become loose and are lost because their attachment has been destroyed by disease. As a fine house is of little value without a good foundation, so is a good set of natural teeth of little use unless the supporting tissues are healthy; otherwise, sooner or later, these teeth will be lost, and no amount of filling, or crown and bridgework can save them. The diseases which attack the tissues immediately surrounding each tooth, if not too far advanced, can be successfully treated by the dentist who understands their causes and correct method of treatment. It is much better to check them in the beginning, or, what is even more desirable, to prevent them entirely, and in this way preserve the natural support of the teeth throughout life. In order to accomplish this, we must not only care for the teeth but for their foundation as well, by keeping the mouth perfectly clean, hardening the gums by chewing coarse foods and, by means of massage, stimulating the circulation in the deeper structures surrounding the teeth. It is also necessary to encourage all the various eliminative processes of the body by way of the kidneys, skin, lungs and intestinal tract, because it is known that the accumula-

*Bulletin No. 7. This is one of a series on the teeth and their care prepared for the information of the public.

tion of waste products in the body reduces the natural resistance to disease in all parts of it. The mouth tissues, being a part of the body, are subject to the same laws; hence, in our personal efforts for a healthy mouth, we must also aim for a healthy body.

MASSAGE OF THE GUMS

There has been a general misconception that when the toothbrush is used on the gums they will recede. As incorrect brushing can injure the teeth, so also can it injure the gums, but more harm has resulted from lack of brushing than from incorrect brushing. A toothbrush may be used successfully to clean the teeth and tongue and to massage the gums. However, special instructions are necessary for the correct use of the toothbrush for these purposes.

It is also possible to massage the gums effectually by means of a cotton roll, one inch long, held in an instrument made for the purpose, or with a piece of gauze moistened and used over the index finger. Firm deep pressure over the roots of the teeth is necessary if the latter, simple method is used. In order to preserve the comfort and usefulness of the teeth, it is as necessary to massage the gums as to brush the teeth. In fact, many believe it is of greater importance, if there is a tendency toward disease of the gums.

FAULTY DIET A FACTOR OF DISEASES AFFECTING THE TEETH AND GUMS

The need for this artificial stimulation has been brought about by the modern soft cohesive foods, which require little or no exercise of the masticating machine and which encourage two grave American faults, overeating and hurried eating. The ingestion of many foods belonging to this class (cakes, pies, puddings, hot breads, rolls, biscuits, etc.) results in an accumulation of waste products in the system, which disturbs the normal chemistry of the body and renders elimination difficult. These foods, being cohesive, tend to cling to and about the teeth. As a result, we may have diseased conditions of the gums and teeth traceable to a faulty diet. Another common dietetic error is the overeating of protein foods, especially meats, poultry, fish, legumes, eggs and cheese. This encourages poor elimination, often manifesting itself in periodontoclasia. So we see that the care of the mouth is not purely a mechanical process, but we must also consider the physiologic aspect of the tissues involved and their relation to the body, as well as our general health habits and their relation to the teeth.

SUGGESTIONS FOR IMPROVING A FAULTY DIET

To promote the health of the mouth, we should eat a moderate amount of starches and sugars, also of proteins, and a generous amount of coarse yellow vegetables, green leafy vegetables, glandular organs and fresh ripe acid fruits. It is better to end meals with fresh ripe fruit or a vegetable salad rather than the usual soft, adhesive pudding, pastry or cake. The former is desirable not only for the cleanliness and health of the mouth, but for the cleanliness and health of the body cells. If we choose the wrong type of food, it is of great importance that we pay the price by eternal vigilance in the use of artificial measures to combat uncleanliness and disease. The general tissue tone of the tooth support must be built up and main-

tained in either case, in order that the teeth may be maintained in a state of health and usefulness.

GOOD RESULTS OBTAINABLE BY THE PATIENT'S OWN EFFORTS

Correct personal efforts in mouth hygiene should have the following results:

1. The reduction of mouth bacteria to a minimum, on teeth, gums and tongue.
2. Complete removal of films, visible soft deposits and food remnants.
3. Prevention of formation of salivary calculus (through diet if necessary).
4. Improved circulation in the supporting tissues.
5. Thickening of epithelium with greater resistance to bacterial invasion.
6. Marked reduction of sensitiveness in the gum tissues.
7. Marked reduction in cavities of the teeth in most cases (dietary reform may be necessary).
8. Prevention of gum disease in all cases which present no mechanical or physiologic obstacles.
9. Improvement of gingival tone, causing a tightening of the gums around the teeth.
10. Prevention of development of unclean areas between the teeth.
11. Use of both sides of the masticating machine on resistant foods.

No personal efforts are complete unless accompanied by improved processes of elimination and an adequate diet suited to the individual's needs.

EQUIPMENT

The minimum equipment needed to accomplish the foregoing results are:

1. Two small toothbrushes with, preferably, two rows of tufts set fairly wide apart, of good quality medium bristles not more than ⅜ inches long.

The films of bacteria, mucus and food remnants that cling to the tooth surfaces are gluey and adherent and require force and time for their removal. Soft bristles or those which are not thoroughly dried out between usings are of no use for cleaning the teeth or massaging the gums.

2. Dental floss or tape of medium width.
3. Dentifrices, which should be used with the understanding that it is generally the toothbrush that does the work and not the toothpaste or powder, in spite of all the claims to the contrary.
4. Mouthwashes. These are optional in the average case. Ordinary salt solution (one level teaspoonful of salt to one glass water) may be used without injury. Antiseptics should be used in moderation.
5. A wall mirror. This is a help in guiding the procedures of toothbrushing and taping and for lending interest; also for checking results.
6. A convenient timepiece, to check up on the time spent in the home care of the mouth.

TIME ALLOWANCE FOR BRUSHING AND TAPING

Not less than nine minutes should be spent each day, six minutes, divided into two periods, with the brush (after breakfast and after the evening meal), and three minutes with floss, before retiring. Smokers and those who overeat, especially of starches, sugars and proteins, should spend more time. This does not include time for the massage of the supporting tissues of the teeth. It is better to brush the teeth after each meal, especially if one continues to eat soft adhesive foods. Brushing the teeth before breakfast is a satisfaction to everyone, but it cannot take the place of mouth cleansing after meals. When we cannot brush the teeth after any meal, we should thoroughly rinse the mouth with pure water to get rid of food particles.

CARE OF THE TONGUE

Use the toothbrush as if it were a broom on the top surface of the tongue, very lightly, sweeping it forward from the base to the tip, with enough firmness to remove the mucus and bacteria which collect on it. Sweep the surface three or four times the first thing in the morning before breakfast. Then rinse the mouth thoroughly. A tongue scraper may be used if great care is taken to scrape lightly so as not to injure the delicate surface structure of the tongue.

CARE OF THE TOOTHBRUSHES

Rinse thoroughly, sprinkle the bristles with salt, and hang the brush up to dry, in the sunshine if possible.

WARNINGS

1. Crosswise brushing may wear the teeth and cause the gums to recede.
2. Careless use of toothpicks may infect the gums, especially in an unclean, unhealthy mouth.
3. Careless use of the dental floss may injure the tooth attachment.
4. The use of injurious dentifrices, of which there are many on the market, may result in wearing grooves in the teeth.
5. In spite of the dangers involved, it is better to care for the mouth by a wrong process than not to care for it at all, provided the toothbrushes are kept clean and have medium bristles. Family toothbrushes are a great menace to the health of the mouth and body. Serious contagious disease may be conveyed by the toothbrush if used by more than one person.
6. Water too hot or too cold should not be used as it shocks the pulps in the teeth.
7. Lack of thorough mastication of food on both sides of the mouth results in lack of use of some of the teeth and this encourages disease in and around them.

METHODS OF MOUTH BRUSHING

Dental authorities differ as to what is the best method of brushing the teeth and on the size and shape of toothbrushes. For this reason, four methods are described below, two for healthy mouths and two for persons with unhealthy mouths, or those

who have a tendency toward diseases of the gums. Each one of the four methods has produced gratifying results in thousands of mouths. Your dentist will advise you as to which one will be best for you to study and master.

Cleaning the Tops of the Teeth.—This is very important for children. The first surfaces of the teeth to be brushed are the grinding surfaces. The brush is

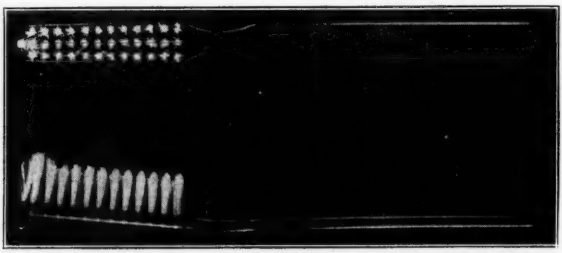


Fig. 1.—Large brush, used for circular method.

placed with the bristle ends against the grinding surfaces of the teeth and the handle held in the palm of the hand. A group of two or three teeth are brushed at a time. The handle is given a short to and fro motion, rocking the bristle ends carefully into the grooves and pits. The bristles do not jump from tooth to tooth, but remain working in one spot. The pressure should be sufficient to scour the deepest grooves in the teeth but not to crush or flatten the bristle tufts. The brush is then moved to a new group of teeth, and so on, until all the grinding surfaces are cleaned. For the other tooth surfaces, there are the following methods.

NORMAL MOUTHS

1. *The Circular Method.*—This method is designed to simplify mouth cleansing and tissue stimulation for use in mass education, and no system requiring more

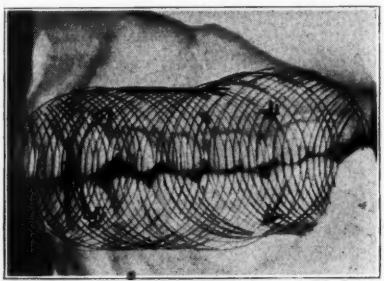


Fig. 2.—Circular motion given brush on left side and in front on teeth and gums.

than two minutes is practical for this purpose. The brush must be adaptable to all the irregular surfaces of the mouth. Therefore, it should be a large, straight brush, with only a low tuft of bristles at the toe end. There is the common danger in all

forms of gum stimulation that the tissues will be injured by the bristle ends causing irritation from undue pressure. A large brush diminishes the pressure per bristle end and distributes it more evenly over the gum surface.

(a) Outside surfaces: Place the toothbrush inside the left cheek and on the upper gums, and nearly close the teeth. Make the brush go backward and downward

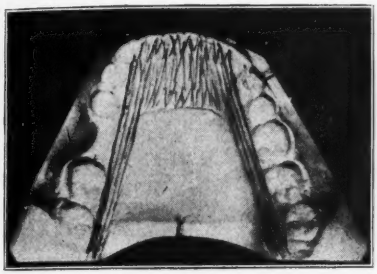


Fig. 3.—Lines indicating direction brush should travel (lower jaw).

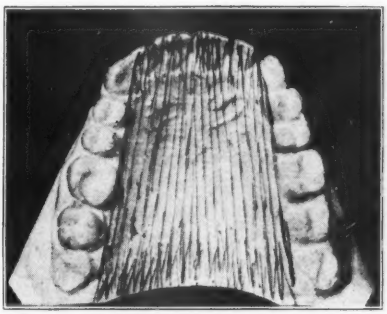


Fig. 4.—Lines indicating direction brush should travel (upper jaw).

to the lower gums, then slightly forward and upward until it has traveled a complete circle. This circular motion should be done rapidly so that the gums will be stimulated and the teeth cleansed of food. Keep up this fast circular motion and brush all the teeth on the left side as well as all of the front teeth. Do not brush the teeth and gums crosswise. Now brush the right side with the same circular motion, or reversing the circle, if found more convenient. Brush long enough to stimulate the gums thoroughly and cleanse the teeth, going back and forth over all the surfaces several times.

(b) Inside surfaces of upper teeth and roof of mouth: With the bristles of the brush pointing upward and the end of the thumb on the back of the handle, brush the roof of the mouth and the inside gums and surfaces of the teeth with a fast

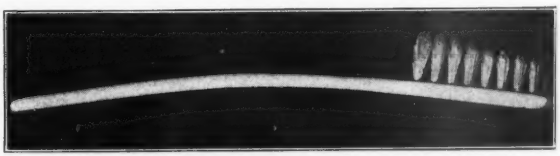


Fig. 5.—Brush used for modified rolling method.

in-and-out stroke, reaching back on the gums as far as you can go. Go back and forth across the roof of the mouth with this in-and-out stroke at least four times.

(c) Inside surfaces of lower teeth and gums: Hold the handle of the toothbrush in the fist with the thumb lying across the back of the handle and brush the gums and teeth with an in-and-out stroke, using chiefly the tuft end or toe of the

brush. Reach back in the mouth on the gums below the last tooth on both sides and brush with a fast, light in-and-out stroke. Tip the handle of the brush up in brushing the gums back of the lower front teeth.

(d) Tops of teeth or grinding surfaces: Lastly, brush the teeth with an in-and-out stroke on the surfaces on which you chew, as the food must be removed from the grooves or fissures of the molars.

Rules to remember: 1. Brush four times a day: before breakfast, with clear water, and after each meal, with a tooth paste or powder. The teeth must be clean and free from food before going to bed, as most of the decay takes place while sleeping.

2. Brush two minutes each time (two minutes by the clock). It takes two minutes of brushing to stimulate the gums properly and thoroughly cleanse the teeth. Be sure to brush the gums.

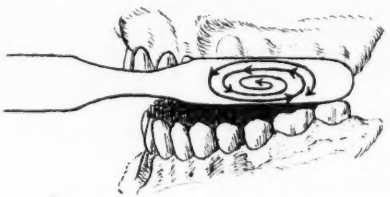


Fig. 6.—Position of brush on cheek side of upper back teeth.

Fig. 7.—Position of brush on lip side of lower front teeth.

3. Do not use pressure with the brush. A fast, light stroke is the best. A brush should never be worn out by having its bristles flattened and spread out.

2. *The Modified Rolling Method.*—Use a small toothbrush like that shown in Figure 5. Separate the jaws while brushing, first the upper teeth and then the lower teeth.

Upper teeth: Grasp the toothbrush handle firmly with the bristles pointing upward and place the toothbrush in the mouth between the cheek and gums as far back as the last tooth, laying the sides of the bristles against the gums. Then, sweep downward over the gums and teeth by rolling the handle of the toothbrush and wrist inward. Repeat this in the same location several times until the teeth are clean; then, move the toothbrush forward to the next group of teeth not reached by the first position and so continue until all the outer tooth surfaces are cleansed and the gums massaged, always remembering to place the ends of the bristles up and the side of the bristle part of the brush against the gums before rolling the handle. Clean the inside surfaces of the upper teeth in the same manner.

Lower teeth: The lower teeth are cleaned similarly except that it is of course necessary to turn the ends of the bristles downward before placing the brush in the mouth and laying the bristle part of the brush against the gums. Then sweep upward over the gums and teeth, as often as required in each location. Clean the inside surfaces of the lower teeth in the same manner.

For the grinding surfaces, see the foregoing description under the heading "Cleaning the Tops of the Teeth."

Fig. 8.—Brush used for immunizing hard and soft mouth tissue to infection.

MOUTHS SHOWING A TENDENCY TOWARD DISEASE OF THE GUMS

1. *Immunizing Hard and Soft Mouth Tissue to Infection.*—Place the brush at right angles to the long axis of the teeth, the points of the bristles in contact with the surfaces; then, gently force the bristles between the teeth, being careful not to pierce the gums: that is, do not allow the points of the bristles to rest on the gums. With the bristles between the teeth, exert as much pressure as possible, giving the brush several slight rotary or vibratory movements, causing the sides of the bristles to come in contact with the gum margin and producing an ideal massage. Be careful not to make the movement sufficient to remove the bristles from between the teeth. After making three or four small circles, remove and replace in the same area. Make three or four applications in the same place. The reason for this is that the points of the

Fig. 9.—Brush used for physical culture of the gums.

bristles strike the labial, buccal and lingual surfaces, then slide into the interproximal spaces. Move the distance of one embrasure and repeat the process, holding the sides of the bristles firmly on the gum margin. The V-shaped spaces between the teeth assist in crowding the sides of the bristles against the gingivae. Where teeth are missing, we have to depend on our sense of touch to keep the proper pressure, with the sides of the bristles on the gum margin.

Be sure to enter every embrasure from both the outer and the inner surface on both the upper and lower teeth. Most of the third molars, which, because of the close proximity of the ramus of the jaw and the soft tissue in that region, cannot be approached at right angles, must receive more careful attention, and the brush should be tipped so that the bristle ends reach the outer and inner sides. Third molars in proper alinement and occlusion can be saved as long as any other teeth if they are kept as clean.

Lastly, but very important, do not brush the chewing occlusal or grinding surfaces with a sliding or sweeping motion, but place the brush directly on this surface, then gently force the bristles into the pits and fissures, giving a slight rotary movement. Remove and repeat until the entire chewing or biting surface has been brushed.

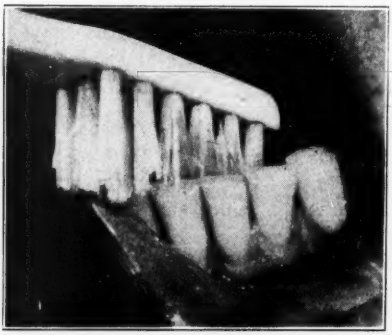


Fig. 10.—Position of brush on tongue side of lower front teeth.

Fig. 11.—Position of brush on tongue side of lower back teeth.

When the teeth have been thoroughly brushed according to the method that I have just described, the next important point for consideration is proper rinsing of the mouth. The brush removes little food accumulations from the mouth. The film, with the aid of the saliva, forms a liquid that fills the fissures and embrasures.

It is important that this so-called accumulation of waste food be washed out of the mouth. After taking a mouthful of water at body temperature, with the teeth and lips occluded, the water is forced back and forth through the interproximal spaces with as much pressure as possible. An abundance of water is used for this purpose, the idea being to wash the bacteria out of the mouth, rather than try to destroy them in the mouth by an antiseptic.

The brush: The brush should be seven-eighths inch from heel to toe and five-sixteenths inch in width, and the bristles one-half inch in length. The tufts should be separated from each other about the width of the tuft. The top of the tufts should

be saw shaped. The handle of the brush should be 7½ inches in length and made rigid, preferably of bone. (Fig. 8.)

2. *Physical Culture of the Gums.*—For this method, use a toothbrush like the one here illustrated. (Fig. 9.)

The circulation of blood in the gums largely determines the health of the teeth, for it has both to supply nourishment and to remove the waste products. The only exercise the teeth and gums can ever get naturally is from the pressure of food on them during mastication, but most of us, nowadays, do not eat tough foods that compel vigorous mastication. We should, therefore, introduce artificial exercise for the gums and teeth if we expect to have teeth all our life.

If you will look in a mirror and press the tip of a finger on the edge of the gum, you will observe that the gum whitens over a considerable area. Pressure drives the blood away. By alternately pressing and releasing the pressure, you can "pump" the blood in and out of the blood vessels of the gums.

Stand before a mirror and place the brush gently on the edge of the gums of the two upper central teeth, partly resting on the teeth and partly on the gums. Slant the brush so that the bristles point upward at an angle of 45 degrees, not directly upward toward the ends of the roots. Now, bend the bristles slightly by pressing gently. Bend them as a paint brush bristle is bent. Lift the tip with the fingers. You will notice that the gums whiten. Now, raise the brush a little. Release the pressure. Immediately the blood rushes back into the whitened area and the gum resumes a redder tint. It "blushes," owing to the inrush of new blood. Alternately, press on the gums and then release the pressure, forcing the blood from the tissues and letting it return. The release is as important as the pressure.

Now press the brush on the gums and teeth as before, and move the handle slightly back and forth, or with a slight rotary motion, keeping the bristle ends, however in the same spot on which you placed them. This is made possible by the pliability of the bristles.

Care should be taken that the bristle ends never scrub across the teeth, nor up, nor down, but seem to rotate slightly as you alternately press the brush on gums, and then release the pressure. Continue the exercise until you are conscious of having the glow of health.

Begin with the upper teeth and exercise the gums two teeth at a time. Go over the entire upper row of teeth, inside and out, "tongue-side," "lip-side," and "cheek-side." Then, do the same for the lower teeth, both inside and out. Do not scrub. We desire stimulation, not irritation.

If you have tartar on your teeth, it should be removed by your dentist, who will also polish your teeth carefully.

(The circular method, immunizing hard and soft mouth tissue to infection and physical culture for the gums have each been described by their authors.)

After brushing the teeth according to any one of the foregoing methods, it is of great importance that the mouth be thoroughly rinsed with lukewarm water forced back and forth between the teeth several times.

The Method of Using Dental Floss.—The use of dental tape is condemned by many dentists. Nevertheless, if it is correctly used, it is of value in helping to prevent cavities on and near tooth surfaces touching each other. There should not be more than one-half inch of dental tape between the hold of one hand and the hold of the other on the floss, by which means it can be well controlled. Carefully draw it back and forth between two teeth rubbing the surface of one tooth until the floss is worked past the contact point of the two teeth. Then rub the surface of the other tooth by drawing the floss back and forth until it is worked out from between the teeth. Use it in the same manner between all of the teeth and on the last surface of the last tooth on each side of each jaw. Do not injure the gums. If they bleed, either they are unhealthy or the dental floss is not being used correctly.

While there are many factors in the control of oral health, there is no one

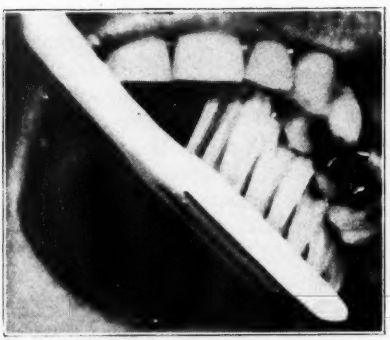


Fig. 12.—Position of brush on tongue side of upper back teeth.

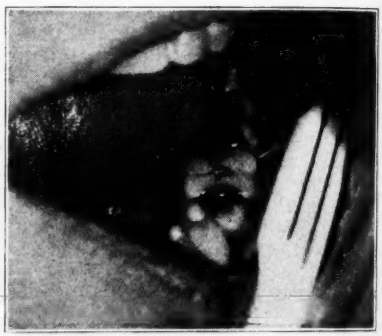


Fig. 13.—Position of brush on cheek side of lower back teeth.

other which is so easily applied or so far reaching in its effect as the personal home care of the mouth. Nevertheless, beyond what the patient can do for himself, there is often much that the dentist needs to do in establishing and maintaining oral health. Therefore, do not fail to consult a good dentist as often as your case requires his services.

LAUGHING GAS*

By Julian Alexander, LL.B., Jackson, Miss.

The dentist, through the use and abuse of an explorer's license usually, makes it his business to know everything that goes on beneath our very noses. But he doesn't always sense all that is going on inside the head of his patient; for, under the stimulus of laughing gas, he often takes weird excursions into the realms of imagination.

What is that hallucination that comes to his disordered brain, distorted by the fanciful delirium of a real nitrous oxid jag?

My revelations may furnish practical data for your journals as a significant subjective symptom.

The oral cavity assumes a unique aspect, being magnified to the proportions of a vaulted convention hall. The delegates are assembling. The first arrivals are slim young fellows who come early—in fact, as soon as the doors are open and the roll call is ready. They are the milk or baby teeth, who take charge of the front seats but display an impatience which bespeaks only a casual interest in the proceedings. They are admitted on a half-ticket on the theory that they expect to stay through but half the proceedings. The trouble and disorder that they occasion leads to the suspicion that they are not vitally concerned with the final vote. They have the air of those who have been bribed to stand in line and preempt the front rows for some of the grown folks.

The seats next to them are taken by the canines, who, ignoring the sign "no dogs allowed," come crashing in and take seats in the orchestra and first balcony. They join with the baby teeth in making the most of the present, with every indication of indifference to the ultimate success of the party.

The next arrivals often cause some dispute with the ticket takers. The bicuspids behind the canines come in with half-tickets calling for aisle seats. There is always some haggling over the admission fee because now and then one of these tricky fellows gains admittance on a half ticket and stays through for the whole show.

But who are these dignified and portly gentlemen who stalk in with such stately tread? The old bow-legged molars with seat checks in sections B and C enter with all the studied unconcern of those whose seats both in the balcony and the main floor are reserved. Not infrequently, one of these personages sits sideways in his chair to view the incoming delegates, later shifting laboriously to get a view of the stage.

As soon as all the old "bi-cusps" are seated and the disorder on the front rows has been quelled by demanding a surrender of credentials on the part of the juvenile contingent, the meeting is called to order.

The roll call of the delegates is hardly completed before all heads are turned to diagnose the disturbance caused by the boisterous entrance of the "Calamity Quartet," who, ignoring the doorkeeper's protests, make a dramatic eleventh-hour entrance, bearing credentials as third molars.

Of course, there are no more seats, and they are discourteously shoved along from one to another and finally seek a place in the back row, where they squeeze in sideways and hang their feet out in the aisle. Resentful of their reception, they lose no opportunity to disorganize the meeting. They heckle the speaker, vote "no" on every motion, bring in disturbing minority reports and make themselves so obnoxious generally that they are finally forcibly ejected from the hall.

Nor is perfect harmony ever thereafter restored. Now and then, one of the delegates, wearied by the proceedings, quits the hall, and surrenders his place to a rank outsider, who takes the vacated seat, but leans heavily on his neighbors and asks them how to vote.

One by one, the delegates retire on one pretext or another. A few of the typical politicians are induced to hang on because a bit of gold is slipped to them, but even then they ultimately lose interest in the program and join the general exodus.

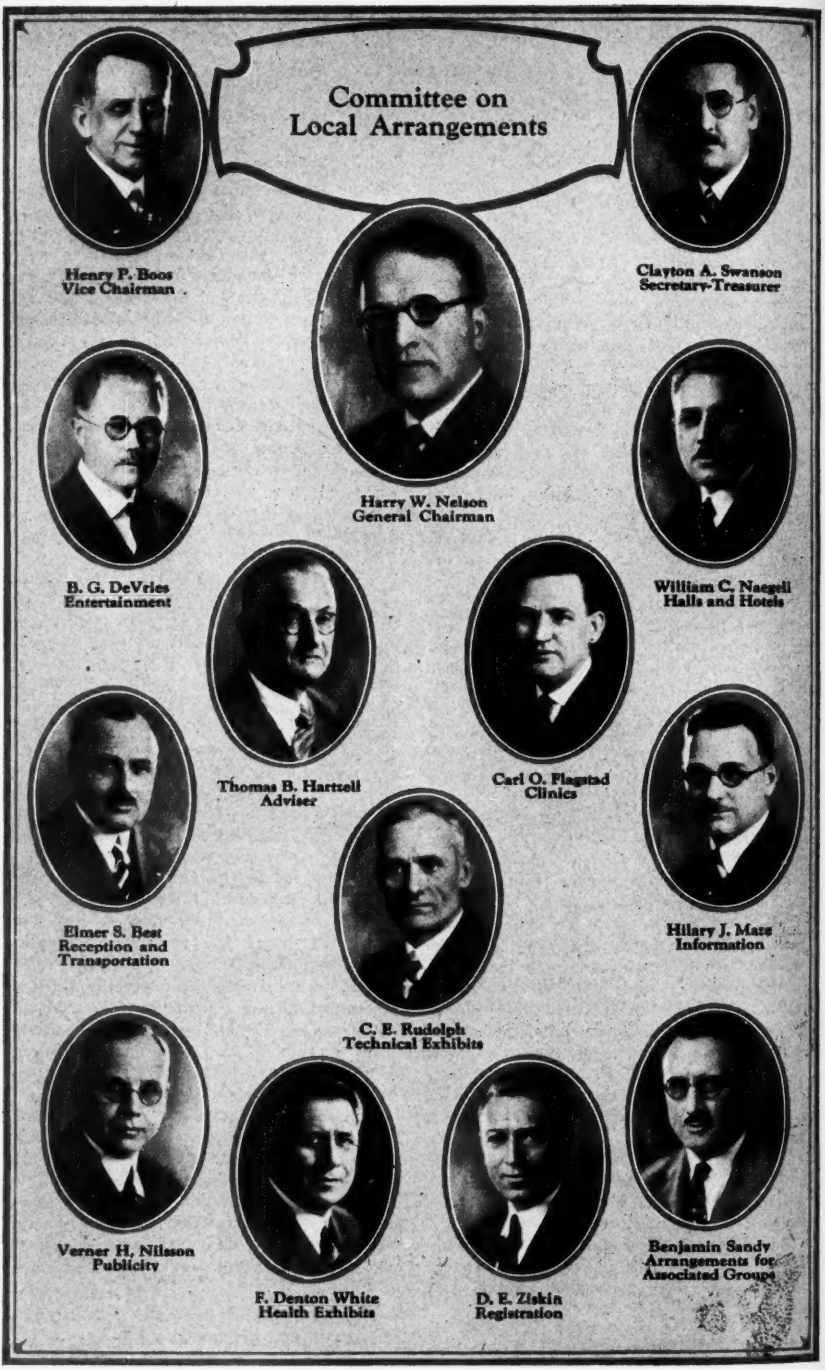
Only the janitor remains. There is no one to boss him, no one to oppose or argue with him, and he too takes a final look about the place and with a leaden heart quits his job. As he passes out, he is met by a solid delegation of aliens who storm past him in solid phalanx, bringing their own seats, and singing, "The Old Place Ain't What She Used to Be"!

The whole works has gone democratic.

—Well, they call it "laughing gas."

But it is no laughing matter.

*Experience of a layman recounted at banquet of Mississippi Dental Association, Jackson, April 17, 1928.



THE COMMITTEE ON LOCAL ARRANGEMENTS, SEVENTIETH ANNUAL SESSION OF THE AMERICAN DENTAL ASSOCIATION, MINNEAPOLIS, MINN., AUGUST 20-24, 1928.

AMERICAN DENTAL ASSOCIATION SEVENTIETH ANNUAL SESSION

MINNEAPOLIS, MINN., AUG. 20, 21, 22, 23, 24, 1928

OFFICIAL CALL

To the Members of the American Dental Association:

You are hereby notified that the Seventieth Annual Session of the American Dental Association will be held at Minneapolis, Minn., Aug. 20-24, 1928.

The House of Delegates will convene at 10:00 o'clock in the forenoon and at 2:30 o'clock in the afternoon, Monday, August 20, in the Radisson Hotel. The third meeting of the House of Delegates will be held on Wednesday, August 22, at 2:30 o'clock in the same hotel. The fourth meeting of the House of Delegates will be held on Thursday, August 23, at 2:30 o'clock in the Garrick Theater. The Credentials Committee will register Delegates and Alternates, beginning at 10:00 a. m., Sunday, August 19, at the Radisson Hotel.

All other members must register at the Registration Office in the Minneapolis Auditorium. The Registration Department will be open from 10:00 a. m., until 5:00 p. m., on Sunday, August 19, and from 8:30 a. m., until 5:00 p. m., on Monday, Tuesday, Wednesday, Thursday and Friday, August 20, 21, 22, 23 and 24.

The general meeting, which constitutes the opening exercises of the Session, will be held Tuesday, August 21, at 9:30 a. m., in the Garrick Theater. The second and third general meetings will be held on Tuesday and Wednesday, August 21 and 22, at 8:00 p. m., in the Garrick Theater.

The various sections, general clinics, section clinics, dental health exhibit, scientific exhibit, motion picture program and technical exhibits will be held in the Minneapolis Auditorium, according to their respective programs.

The constituent societies are hereby notified to file with the Secretary of this Association, at least thirty (30) days prior to the first day of said Annual Session, a list of the names and addresses of their Delegates and Alternates.

ROSCOE H. VOLLAND, *President.*
HARRY B. PINNEY, *Secretary.*

GENERAL PROGRAM

Registration (General) ..... Sunday, August 19, 10:00 a. m.
(Minneapolis Auditorium)

Registration (Delegates and Alternates) ..... Sunday, August 19, 10:00 a. m.
(Gold Room, Radisson Hotel)

Board of Trustees (First Meeting) ..... Saturday, August 18, 10:30 a. m.
(Spanish Room, Radisson Hotel)

Board of Trustees (Second Meeting) ..... Saturday, August 18, 2:30 p. m.
(Spanish Room, Radisson Hotel)

House of Delegates (First Meeting) ..... Monday, August 20, 10:00 a. m.
(Gold Room, Radisson Hotel)

House of Delegates (Second Meeting) ..... Monday, August 20, 2:30 p. m.
(Gold Room, Radisson Hotel)

House of Delegates (Third Meeting) ..... Wednesday, August 22, 2:30 p. m.
(Gold Room, Radisson Hotel)

House of Delegates (Fourth Meeting) ..... Thursday, August 23, 2:30 p. m.
(Garrick Theater)

PRELIMINARY PROGRAM FOR MINNEAPOLIS SESSION

FIRST GENERAL MEETING

(Garrick Theater)

TUESDAY, AUGUST 21, 1928

9:30 a. m. Organ Recital
Chandler Goldthwaite ..... Minneapolis, Minn.

10:10 a. m. Invocation

10:15 a. m. Music
Cecilian Quartette ..... Minneapolis, Minn.

10:40 a. m. Address of Welcome from the State of Minnesota
Governor Theodore Christianson ..... St. Paul, Minn.

10:50 a. m. Greetings from the City of Minneapolis
Mayor George E. Leach ..... Minneapolis, Minn.

11:00 a. m. Address of Welcome from the Minnesota State Dental Association
C. E. Rudolph, President ..... Minneapolis, Minn.

11:15 a. m. Response of American Dental Association to Address of Welcome
J. V. Conzett ..... Dubuque, Iowa

11:30 a. m. Music
Mrs. F. B. Whinery ..... Iowa City, Iowa

11:50 a. m. President's Address
Roscoe H. Volland ..... Iowa City, Iowa

Recessional
Chandler Goldthwaite ..... Minneapolis, Minn.

SECOND GENERAL MEETING

(Garrick Theater)

TUESDAY, AUGUST 21, 1928

7:45 p. m. Organ Recital
Chandler Goldthwaite ..... Minneapolis, Minn.

8:15 p. m. Soprano Solo
Mrs. C. F. Bowen ..... Minneapolis, Minn.

8:30 p. m. Address
Glenn Frank, President of the University of Wisconsin ..... Madison, Wis.

Recessional
Chandler Goldthwaite ..... Minneapolis, Minn.

THIRD GENERAL MEETING

(Garrick Theater)

WEDNESDAY, AUGUST 22, 1928

7:45 p. m. Organ Recital
Chandler Goldthwaite ..... Minneapolis, Minn.

8:15 p. m. Music
Male Quartette ..... Minneapolis, Minn.

8:30 p. m. Address
Charles H. Mayo (M. D.) ..... Rochester, Minn.
(Introduced by Senator Henrik Shipstead of Minnesota)

Brophy Tribute

Recessional
Chandler Goldthwaite ..... Minneapolis, Minn.

Bridge Approaching Minneapolis.

THE SCIENTIFIC SECTIONS

TUESDAY, AUGUST 21
OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room A, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

George W. Hillias, Chairman.....Kansas City, Mo.
F. W. McDonald, Vice-Chairman.....New York City
H. B. McCarthy, Secretary...Baltimore, Md.

2 to 5 p. m.

"Oral Diagnosis"
By Earl H. Westenhaver.....Kansas City, Mo.

Discussed by
Carl W. Waldron...Minneapolis, Minn.
Boyd S. Gardner.....Rochester, Minn.

"Alloy"
By R. C. Seibert.....St. Louis, Mo.

Discussed by
J. Ben Robinson.....Baltimore, Md.
John T. Hanks.....New York City

"Root Canal Therapeutics"
By Edgar D. Coolidge.....Chicago, Ill.

Discussed by
Carl J. Grove.....St. Paul, Minn.
J. R. Blayney.....Chicago, Ill.

FULL DENTURE PROSTHESIS

(Section Room B, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Victor H. Sears, Chairman..New York City
I. V. Duell, Vice-Chairman...Louisville, Ky.
E. B. Owen, Secretary.....St. Louis, Mo.

2 to 5 p. m.

"Esthetic Considerations in Full Dentures"
By Arthur T. Rowe.....New York City

Discussed by
Edward H. Bruening.....Omaha, Nebr.
K. D. Park.....Painesville, Ohio

"Monson Technic for Full Denture Construction"
By R. G. Keyworth.....St. Paul, Minn.

Discussed by
O. M. Dressen.....Milwaukee, Wis.
A. Wolfson.....Newark, N. J.

"Practical Application of Research Results in Denture Construction"
By Alfred Gysi.....Zurich, Switzerland

PARTIAL DENTURE PROSTHESIS

(Section Room C, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Nye White Goodman, Chairman.....Los Angeles, Calif.
Edward H. Hubbuch, Vice-Chairman.....Louisville, Ky.
William A. Squires, Secretary.NewYork City

2 to 5 p. m.

"What Constitutes an Ideal Partial Denture"
By Herman E. S. Chayes.NewYork City

Discussed by
Harry Morton.....Milwaukee, Wis.
I. Lester Furnas.....Cleveland, Ohio

"The Effect of Properly Constructed Movable-Removable Restorations on Underlying Bone Structure"
By S. Marshall Weaver.Cleveland, Ohio

Discussed by
William A. Squires.....New York City
J. E. Nyman.....Chicago, Ill.

"Dental Anatomy—A Graphic Representation of Tooth Form with a Simplified Technic for Its Reproduction"
By M. Diamond.....New York City

Discussed by
James M. Prime.....Omaha, Nebr.
Austin F. James.....Chicago, Ill.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room G, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Joseph P. Wahl, Chairman.New Orleans, La.
A. L. Frew, Vice-Chairman...Dallas, Texas
Roy S. Hopkinson, Secretary.....
.....Milwaukee, Wis.

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2 to 5 p. m.

"Intra-Oral Cystectomy"
By A. B. Vastine.....Danville, Pa.

Discussed by
V. H. Kazanjian.....Boston, Mass.
Emil L. Aison.....Chicago, Ill.

"Postoperative Considerations in the Extraction of Teeth"
By Boyd S. Gardner...Rochester, Minn.

Discussed by
George C. Fahy.....New Haven, Conn.
Earle H. Thomas.....Chicago, Ill.

"The Diagnosis and Treatment of Tumors of the Mouth and Jaws"
By Carl W. Waldron.....
.....Minneapolis, Minn.

Discussed by
E. C. Hume.....Louisville, Ky.
Hugh W. MacMillan..Cincinnati, Ohio

"Clinical Manifestations of Oral Foci of Infection"
By C. E. Ervin.....Danville, Pa.

Discussed by
C. H. Burmeister.....Cincinnati, Ohio
Arthur C. Engel.....St. Louis, Mo.

ORTHODONTIA AND PERIODONTIA

(Section Room D, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Arthur H. Merritt, Chairman.....
.....New York City
Charles R. Baker, Vice-Chairman.....
.....Evanston, Ill.
C. H. Gracey, Secretary.....Detroit, Mich.

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2 to 5 p. m.

PERIODONTIA

Symposium—Periodontia for the General Practitioner.

"The Relation of the General Practitioner to Periodontia"
By Alvin Wesley Bryan.Iowa City, Iowa

Leamington Hotel,
Minneapolis, Minn.

Radisson Hotel, American Dental Association Headquarters.

"Preliminary Symptoms of Periodontal Disease"

By Thomas B. Hartzell.Minneapolis, Minn.

"Vincent's Infection—Cause and Treatment"

By Isador Hirschfeld.....New York City

"Periodontoclasia—Cause and Treatment"

By Harold J. Leonard.....New York City

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room F, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

N. Talley Ballou, Chairman..Richmond, Va.
Robin Adair, Vice-Chairman...Atlanta, Ga.
G. H. Wandel, Secretary...Iowa City, Iowa

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2 to 5 p. m.

"Preventive Dentistry from the Point of View of the Pediatrician"

By F. W. Schlutz (M. D.).....
.....Minneapolis, Minn.

"Prenatal Care and Diet"

By F. L. Adair (M. D.).....
.....Minneapolis, Minn.

Discussed by

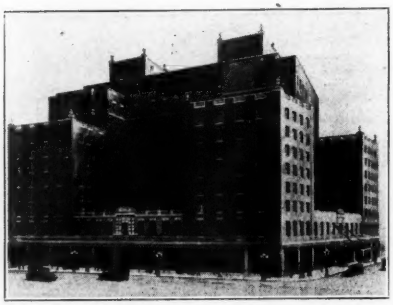
Harold DeWitt Cross.....Boston, Mass.

"Dental Hygiene as Taught in the Schools of Waterloo, Iowa"

By Clella McCullough..Waterloo, Iowa

"Introducing the Child to the Dental Office"

By Gladys Shaeffer.....Lancaster, Pa.



Nicollet Hotel,
Minneapolis, Minn.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E, Minneapolis Auditorium. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Russell W. Bunting, Chairman.....
.....Ann Arbor, Mich.
Alvin Wesley Bryan, Vice-Chairman.....
.....Iowa City, Iowa
Edward H. Hatton, Secretary...Chicago, Ill.

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2 to 5 p. m.

"Some Unusual Features in a Case of Mottled Teeth"

By Clarence W. Hagan...Pittsburgh, Pa.

"A Further Study of the Frequency of Occurrence of Certain Structural Variations in Human Enamel, Dentin and Cementum"

By Lawrence E. Van Kirk.....
.....Pittsburgh, Pa.

"The Dates of Eruption of Permanent Teeth in a Group of Minneapolis School Children"

By Joseph T. Cohen.Minneapolis, Minn.

"Dental Infections and Their Relationship to Diseases of the Eye"

By L. M. Cruttenden....St. Paul, Minn.

WEDNESDAY, AUGUST 22
OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room A.)

9 a. m. to 12 m.

"Roentgenography"

E. C. Hume.....Louisville, Ky.

Discussed by

S. M. Getzoff.....New York City
W. A. Cook.....Detroit, Mich.

"Orthodontia"

By Hugh G. Tanzey..Kansas City, Mo.

Discussed by

J. W. Ford.....Chicago, Ill.
Abram Hoffman.....Buffalo, N. Y.

"Cavity Preparation"

By Ralph R. Byrnes.....Atlanta, Ga.

Discussed by

Perry F. Gilbreath....Kansas City, Mo.
W. F. Whalen.....Peoria, Ill.

FULL DENTURE PROSTHESIS
(Section Room B.)

9 a. m. to 12 m.

"Mandibular Movements"
By David S. Highkin....Baltimore, Md.
Discussed by
H. F. McGrane.....Omaha, Nebr.
Harry G. Morton.....Milwaukee, Wis.

"Means of Increasing Efficiency and Minimizing Trauma in Full Dentures"
By A. Y. Russel.....Baltimore, Md.
Discussed by
R. L. Christy.....Denver, Colo.
A. Alfred Nelson.....Detroit, Mich.

"The Passing of the Articulator Question and the Revival of Learning in the Study of Occlusions"
By H. I. Rothschild.....Buffalo, N. Y.
Discussed by
G. W. Holliday.....Richmond, Va.
J. W. Crawford.....Milwaukee, Wis.

"Why and How to Make Individual Mouth Records"
By Elmer W. Bunce..Los Angeles, Calif.
Discussed by
James J. Guerrero.....Chicago, Ill.
C. J. Stansbery.....Seattle, Wash.

PARTIAL DENTURE PROSTHESIS
(Section Room C.)

9 a. m. to 12 m.

"Dental Pulp Pathology and Its Relation to Restorative Dentistry"
By O. DeForest Davis..Cleveland, Ohio
Discussed by
J. R. Blayney.....Chicago, Ill.
Carl J. Grove.....St. Paul, Minn.

"The Pulpless Tooth—Its Pathology and Treatment and a New Method of Filling a Root Canal"
By John P. Buckley...Hollywood, Calif.
Discussed by
Edward H. Hatton.....Chicago, Ill.
Edouard M. Hall.....Kansas City, Mo.
Elmer S. Best.....Minneapolis, Minn.

"Occlusodontia and Restoration"
By E. Ray Brownson.Los Angles, Calif.
Discussed by
J. H. Hospers.....Chicago, Ill.
A. Alfred Nelson.....Detroit, Mich.

ORAL SURGERY, EXODONTIA AND ANESTHESIA
(Section Room G.)

9 a. m. to 12 m.

"Conservative and Efficient Surgery for Empyema of the Antrum"
By Arthur E. Smith..Los Angeles, Calif.
Discussed by
Roy S. Hopkinson.....Milwaukee, Wis.
R. Boyd Bogle.....Nashville, Tenn.

"Some Things the Dentist Should Know of Anesthesia" (With moving picture showing technic for nitrous oxid-oxygen anesthesia.)
By E. I. McKesson.....Toledo, Ohio
Discussed by
Edward L. Moravec.Cedar Rapids, Iowa
Martin L. DeBats.....Detroit, Mich.

"Surgery of the Alveolar Process and Tooth Extraction"
By J. P. Henahan.....Cleveland, Ohio
Discussed by
J. A. Blue.....Birmingham, Ala.
Arnott A. Moore.....Buffalo, N. Y.

"Cancer of the Mouth"
By A. T. Rasmussen....La Crosse, Wis.
Discussed by
Harvey D. Barnett.....St. Paul, Minn.
George W. Christianson..Detroit, Mich.

Andrews Hotel,
Minneapolis, Minn.

ORTHODONTIA AND PERIODONTIA

(Section Room D.)

9 a. m. to 12 m.

ORTHODONTIA

"A Method of Keeping Records"
By O. W. Brandhorst.....St. Louis, Mo.
Discussed by
J. D. Williams.....St. Louis, Mo.

"Early Loss of Teeth—A Study of Effects"
By Burne O. Sippy.....Chicago, Ill.
Discussed by
John C. McGuire.....Evanston, Ill.

"The Correction of Vertical Relationship in Distoclusion Cases"
By F. A. Delabarre.....Boston, Mass.

"Intercepting Certain Types of Malocclusion"
By R. C. Willett.....Peoria, Ill.
Discussed by
A. C. Rohde.....Milwaukee, Wis.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room F.)

9 a. m. to 12 m.

"Preventive Orthodontia"
By F. A. Delabarre.....Boston, Mass.

"The Dental Hygienists' Opportunity for Public Health Service"
By Harriett Fitzgerald..Berkeley, Calif.

"Pathology and Treatment of the Soft Tissues in the Mouths of Children"
By F. B. Rhobotham.....Chicago, Ill.

"The Maine Mouth Hygiene Program"
By Dorothy Bryant.....Augusta, Maine

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY, AND CHEMISTRY (RESEARCH)

(Section Room E.)

9 a. m. to 12 m.

"Morphology and Growth of the Fusiform Micro-Organisms"
By Theodore B. von Beust.....
.....Louisville, Ky.

"The Control of Bacillus Acidophilus Overgrowths in the Mouth"
By Russell W. Bunting, Mary C. Crowley (A. B.), Dorothy G. Hard and Margrowths in the Mouth"

"Bacillus Acidophilus and Dental Caries"
By Philip Jay.....Rochester, N. Y.

"Mouth Parasites, Especially E. Gingivalis"
By F. C. Hinshaw (Ph. D.).....
.....Berkeley, Calif.

"Mouth Flora and Relationship to Focal Infection"
By Beatrice Howitt (B. S., M. S.)....
.....San Francisco, Calif.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room A.)

2 to 5 p. m.

"Porcelain Crowns"
By H. W. Oppice.....Chicago, Ill.
Discussed by
Carlisle C. Bastian.....New York City
W. L. Fickes.....Pittsburgh, Pa.

"Gold Foil"
By Carl R. Oman...Minneapolis, Minn.
Discussed by
Arthur G. Smith.....Peoria, Ill.
R. J. Rinehart.....Kansas City, Mo.

"Silicates"
By E. J. C. Smith.....
.....West Hampton Beach, N. Y.
Discussed by
Robert R. Thomas.....Louisville, Ky.
J. H. Phillips.....Nashville, Tenn.

FULL DENTURE PROSTHESIS

(Section Room B.)

2 to 5 p. m.

"Means of Eliminating Shifting of Full Denture Bases"
By L. G. Jordan.....Madison, Ohio
Discussed by
C. E. Rudolph.....Minneapolis, Minn.
A. S. Diack.....Detroit, Mich.

CHAIRMEN AND SECRETARIES OF THE SCIENTIFIC SECTIONS OF THE AMERICAN DENTAL ASSOCIATION, 1928

"Drawn Swaged Bases"
By L. Thomas Asche.....Newark, N. J.

Discussed by
George P. Brenner....Milwaukee, Wis.
W. J. Pryor.....Cleveland, Ohio

"The Practical Application of Engineering to Dentistry"
By Rudolph L. Hanau....Buffalo, N. Y.

Discussed by
R. R. Gillis.....Hammond, Ind.
G. F. Bell.....Conneaut, Ohio

PARTIAL DENTURE PROSTHESIS

(Section Room C.)

2 to 5 p. m.

"Operative Instrumentation for Jacket Crown Preparation"
By Albert L. LeGro.....Detroit, Mich.

Discussed by
E. L. Pilkington.....Detroit, Mich.
H. W. Oppice.....Chicago, Ill.

"Partial Gold Denture Clasp Attachments"
By Edward T. Tinker.....
.....Minneapolis, Minn.

Discussed by
Carlisle C. Bastian.....New York City
R. J. Rinehart.....Kansas City, Mo.

"The Present Status of the One Piece Casting for Partial Dentures"
By F. E. Roach.....Chicago, Ill.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room G.)

2 to 5 p. m.

"The Conduct of an Oral Surgery Practice"
By Theodor Blum.....New York City

Discussed by
Harry Bear.....Richmond, Va.
Frank B. Hower.....Louisville, Ky.

"Radicular Cysts"
By Frederick F. Molt.....Chicago, Ill.

Discussed by
Menefee R. Howard.....Denver, Colo.
Harry M. McFarland.Kansas City, Mo.

"Application of a Very Old Technic to Our Modern Conception of Cleft of the Maxillae"
By E. Carleton Fox.....Detroit, Mich.

Discussed by
William L. Shearer.....Omaha, Nebr.
A. L. Frew.....Dallas, Texas

"The Symptoms of Anesthesia"
By Thomas C. Bonney..Aberdeen, S. D.

Discussed by
J. W. Seybold.....Denver, Colo.
E. D. Bettenhausen.....Duiuth, Minn.

ORTHODONTIA AND PERIODONTIA

(Section Room D.)

2 to 5 p. m.

ORTHODONTIA

"The Deciduous Teeth"
By Walter L. Hyde..Minneapolis, Minn.

Discussed by
Thomas P. Ryan....Minneapolis, Minn.

"Further Experience with Removable Retention"
By C. A. Hawley....Washington, D. C.

Discussed by
B. Frank Gray....San Francisco, Calif.

"The Psychology Involved in Orthodontic Treatment of Children"
By Ray W. Noland...Des Moines, Iowa

Discussed by
Max E. P. Ernst.....St. Paul, Minn.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room F.)

2 to 5 p. m.

"Treatment and Filling Materials Used in Vital Teeth"
By J. E. Gurley....San Francisco, Calif.

Discussed by
C. L. Drain.....Iowa City, Iowa

"The Prognosis and Treatment of Nonvital Teeth"
By W. R. Alvord.....Detroit, Mich.

Discussed by
John M. Clayton.....Kansas City, Mo.

Public Speaking Class. (Anyone is invited to deliver a short speech on any phase of dental health, for criticism as to its effectiveness.)

Conducted by

Bertram G. Nelson (A. B.) .Chicago, Ill.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E.)

2 to 5 p. m.

"Healing of Tooth Sockets Following Tooth Extraction in Dogs"

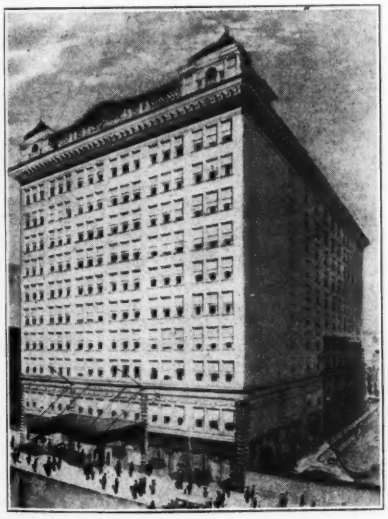
By Warren S. Schram.....Chicago, Ill.

"A Qualitative and Quantitative Consideration of the Blood Cells in Cases with Dental Infection"

By Irving A. Epstein.....
.....Minneapolis, Minn.

"Further Studies on the Management of Pulp Involved Teeth"

By U. G. Rickert, Faith P. Hadley (M. S.) and Chalmers J. Lyons.....
.....Ann Arbor, Mich.



Dyckman Hotel,
Minneapolis, Minn.

"Microscopic Pathology in Pyorrhea"

By F. V. Simonton and Wilhelm Weber (M. D.).....San Francisco, Calif.

"Nasmyth's Membrane"

By Balint Orban (M. D.)..Chicago, Ill.

THURSDAY, AUGUST 23

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room A.)

9 a. m. to 12 m.

"Inlays"

By Herman A. Maves.....
.....Minneapolis, Minn.

Discussed by

A. L. Wilkes.....Los Angeles, Calif.
Charles A. Furrow.....Tulsa, Okla.

"Oral Pathology"

By A. H. Hipple.....Omaha, Nebr.

Discussed by

F. R. Henshaw.....Indianapolis, Ind.
Russell W. Bunting...Ann Arbor, Mich.

"Dental Economics"

By Charles R. Lawrence....Enid, Okla.

Discussed by

J. S. Owens.....Camden, N. J.
C. C. Sparrow.....Minneapolis, Minn.

FULL DENTURE PROSTHESIS

(Section Room B.)

9 a. m. to 12 m.

"The Application of Full Denture Procedures to Other Fields of Dentistry"

By Clyde H. Schuyler...New York City

Discussed by

Dayton D. Campbell..Kansas City, Mo.

"The Work of the National Society of Denture Prosthetists and Its Relation to the American Dental Association"

By E. B. Owen.....St. Louis, Mo.

Discussed by

C. N. Johnson.....Chicago, Ill.

"The Articulating Center as a Practical Aid"

By M. M. Schwartz...Jersey City, N. J.

Discussed by

R. H. Hopkins.....Indianapolis, Ind.
H. B. Washburn.....St. Paul, Minn.

"A Review of Various Full Denture Theories"

By A. E. Boyce.....Tuscola, Ill.

Discussed by

Kent K. Cross.....Denver, Colo.
E. C. Pendleton.....Chicago, Ill.

PARTIAL DENTURE PROSTHESIS

(Section Room C.)

9 a. m. to 12 m.

"The Physical Properties of Precious Metal Alloys and Allied Materials and Their Manipulation in the Construction of Partial Dentures (Results of Cooperative Research at the U. S. Bureau of Standards)"

By Louis J. Weinstein...New York City

Discussed by

William H. Crawford..Memphis, Tenn.
Wilmer J. Souder (Ph. D.).....
.....Washington, D. C.

"Scientific Means of Determining Temperature of Gold and Its Alloys at the Time of Casting by Use of Thermocouple and Pyrometer: Effects of Overheating: Determining Casting Range of Any Gold Alloy: Fractional Volatilization of Wax Patterns"

By Alfred L. Wilkes.Los Angeles, Calif.

Discussed by

H. J. Altfillisch.....Dubuque, Iowa
Merle Wilkinson..Santa Monica, Calif.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room G.)

9 a. m. to 12 m.

"Diffuse Oral Infections — Indications and Contraindications to the Use of Some of the Newer Antiseptics"

By S. L. Silverman.....Atlanta, Ga.

Discussed by

Aubry L. Martin.....Seattle, Wash.
Charles M. Proctor.....Boston, Mass.

"New Fundamentals for the Treatment and Prevention of Dental Disease, Based on Calcium Utilization and Disturbances, with Special Consideration of Factors Determining When an Infected Tooth Becomes a Liability"

By Weston A. Price....Cleveland, Ohio

(Open discussion, limited to three minutes.)

ORTHODONTIA AND PERIODONTIA

(Section Room D.)

9 a. m. to 12 m.

PERIODONTIA

"The Surgical Treatment of Pyorrhea Alveolaris"

By Frank S. Kaiser..Los Angeles, Calif.

"Ultraviolet Radiation in the Treatment of Periodontal Diseases"

By A. T. Rasmussen....LaCrosse, Wis.

Discussed by

Elbert J. Weaver.....Milwaukee, Wis.

"Present Status of the Treatment of Pyorrhea"

By Elbert J. Weaver..Milwaukee, Wis.

"Postoperative Treatment of Periodontoclasia, with End Results"

By Robin Adair.....Atlanta, Ga.

"Postoperative Treatment and Care in Pyorrhea Surgery"

By A. W. Ward...San Francisco, Calif.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room F.)

9 a. m. to 12 m.

"Management of a Juvenile Dental Practice"

By P. R. Thomas....Minneapolis, Minn.

Discussed by

Claude W. Bierman.Minneapolis, Minn.

"Dental Anesthesia for Children."

By E. F. Sullivan.....Boston, Mass.

Discussed by

S. D. Harris.....Detroit, Mich.

"Dental Progress from the Point of View of the Board of Health"

By E. A. Early.....Columbia, S. C.

Public Speaking Class. (Any one is invited to deliver a short speech on any phase of dental health, for criticism as to its effectiveness.)

Conducted by

Bertram G. Nelson (A. B.).Chicago, Ill.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E.)

9 a. m. to 12 m.

"What Constitutes Research: Dental Research in Institutions Other than Dental"
By Edward H. Hatton (B. L., M. D.)
.....Chicago, Ill.

"Hereditary Root Hypoplasia Accompanied by Hyperpigmentation"
By George W. Wilson and Matilda Steinbrecher.....Milwaukee, Wis.

"Gingival Regeneration Following Resection"
By G. R. Lundquist.....Chicago, Ill.

CLINIC PROGRAM

GENERAL CLINICS

(Exhibition Hall, Minneapolis Auditorium.)

OPERATIVE DENTISTRY, CROWN AND BRIDGE WORK, CASTINGS, ETC.

(Section A)

*"Oral Diagnosis"
E. H. Westenhaver....Kansas City, Mo.

"Our Most Used and Most Abused Filling Material"
Hugh M. McElrath.....Murray, Ky.

"Cohesive Gold Foil Fillings (Cohesive Gold in Combination with Cohesive Tin and Noncohesive Gold)"
H. B. Peacock.....Opelika, Ala.

"The Placing of Cohesive and Noncohesive Gold in Proximoclusal Cavities in Bicuspids and Molars"
H. C. Cooper.....Abercrombie, N. D.

"Twenty-Minute Inlays" (Standardizing the following steps in the technic: A. The mix, using electric incubator to hasten the set; B. Boil-out: elimination of wax pattern; C. Casting machine; D. Reducing agent: hydrogen, gas or radio.
F. G. White.....Fort Smith, Ark.

"Demonstrating a Nonexplosive Outer or No. 2 Investment for Inlays, Etc. (A Model Cement. A Practical Double Sprue.)"
H. T. Harvey and Alfred Rothschild
.....Salina, Kan.

"Indirect Inlay Showing Slice Preparation"
Edgar A. Honey, Jr., and Ray L. Workman.....Kalamazoo, Mich.

"Principles of the Casting Process"
Raymond E. Meyers.....Louisville, Ky.

"Investing, Expanding and Casting"
L. V. Kimbrell.....Detroit, Mich.

"Management of Wax for the Direct Inlay"
R. K. Brown.....Ann Arbor, Mich.

"Gold Castings"
F. G. Hartl.....Minot, N. D.

"Crown and Bridge Work"
P. H. Jones.....Atlanta, Ga.

"Perfect Fitting Bands"
William Weichselbaum..Savannah, Ga.

"Movable-Removable Bridgework"
M. Diamond and Milton Cohen.....
.....New York City

"Logical Esthetics in Replacing Natural Extracted Teeth with Carmichael Abutments in Fixed Bridges"
J. A. Tucker.....Canton, Ohio

"Porcelain Jacket Crowns"
Carlisle C. Bastian.....New York City

"Selection and Building of Color for Porcelain Jacket Crowns to Harmonize with the Human Teeth"
J. E. Argue.....Seattle, Wash.

*"Porcelain Crowns"
H. W. Oppice.....Chicago, Ill.

*"New Method and Technic of Filling a Root Canal"
John P. Buckley....Hollywood, Calif.

*"Methods for Pulp Protection During and After Operation"
O. DeForest Davis....Cleveland, Ohio

*Clinics furnished by Scientific Sections.

*"Baking Porcelain Under Pressure"
George A. Thompson.....Chicago, Ill.

*"Root Preparation and Impression Taking for Porcelain Jacket Crown"
Harvey M. Uebele....Milwaukee, Wis.

*"Dental Therapeutics" (Selection of drugs for various uses; preparation of certain drugs for application; caution as to handling some drugs; care required in keeping drugs; containers for dispensing; mode of application.)
Herman Prinz.....Philadelphia, Pa.

*"The Control of Variables in the Casting Process" (A group clinic demonstrating expansion and contraction of waxes and investments, contraction of gold and its alloys, showing castings on natural, steel and porcelain teeth.)
H. A. Maves.....Minneapolis, Minn.

"Finished Inlays, Three-Quarter Veneer and Full Crowns on Natural and Porcelain Teeth for Bridge Abutements on Vital Teeth"
E. J. Sundby and E. H. Goering.....
.....Duluth, Minn.

"Practical Demonstration of Waxing, Investing, Elimination of Wax and Moisture and Casting of a Mesioclusodistal Inlay and a Full Crown on Porcelain Models"
F. S. Meyer.....Minneapolis, Minn.

"Some Features of the Plaster Expansion Technic in Bold Inlay and Crown Construction"
G. A. Stratton.....Oshkosh, Wis.

"Use of Natural Teeth in Anterior Bridgework" (A table clinic showing practical cases; demonstration of construction with porcelain tips and saddles.)
N. E. Uelman and William H. Koch
.....Milwaukee, Wis.

"The Use of Plaster Model Formers"
Edward Drosen.....Milwaukee, Wis.

"Vapor Sterilization and Surgical Nerve Capping and Cavity"
J. P. Carmichael.....Milwaukee, Wis.

"Amalgam, Its Uses and Abuses"
A. W. Albrecht.....West Bend, Wis.

"Three-Quarter Crown and Inlay Technic"
H. B. Felton.....Milwaukee, Wis.

"Correction and Control of Decalcification of Gingival Margins"
H. A. Wagner.....Sheboygan, Wis.

"Porcelain Jacket Crown; Master Model and Instruments" (Showing in detail the consecutive steps of tooth preparation, impression, working models, matrix formation and manipulation of porcelain.)
Nye White Goodman.....
.....Los Angeles, Calif.

"Inlay Technic"
George N. Hollenback.....
.....Los Angeles, Calif.

"Modified Technic for Porcelain Inlays"
Charles E. Burt....Los Angeles, Calif.

"Color in Porcelain"
Jack L. Loop.....San Gabriel, Calif.

"Bridgework, Stressing Porcelain Pontics"
W. F. Andes.....Miami, Fla.

"A Gold Jacket Crown"
A. F. Austin.....Des Moines, Iowa

"Gold Fillings Cast Directly into Porcelain Teeth"
A. M. Lingo.....Muscatine, Iowa

"Porcelain Tips on Pontics in One Bake"
H. A. Boysen.....Waterloo, Iowa

"A Part of Amalgam Technic with Reference to a Simple Adaptation of the Matrix to Obtain Finished Gingival Margins and Close Approximal Contact"
J. B. Richardson....High Point, N. C.

FULL DENTURES
(Section B)

*"Practical Application of Research Results in Denture Construction"
Alfred Gysi.....Zurich, Switzerland

*"The Practical Application of Engineering to Dentistry"
Rudolph L. Hanau.....Buffalo, N. Y.

*"The Articulating Center as a Practical Aid"
M. M. Schwartz.....Jersey City, N. J.

*"The Application of Full Denture Procedures to Other Fields of Dentistry"
Clyde H. Schuyler.....New York City

*"Why and How to Make Individual Mouth Records"
Elmer W. Bunce...Los Angeles, Calif.

*"The Work of the National Society of Denture Prosthetists and Its Relation to the American Dental Association"
E. B. Owen.....St. Louis, Mo.

*"A Review of Various Full Denture Theories"
A. E. Boyce.....Tuscola, Ill.

*"New Denture Materials"
Morris Goldenberg....New York City

*"Esthetic Considerations in Full Dentures"
Arthur T. Rowe.....New York City

*"Monson Technic for Full Denture Construction"
R. G. Keyworth.....St. Paul, Minn.

*"Drawn Swaged Bases"
L. Thomas Asche.....Newark, N. J.

*"Means of Eliminating Shifting of Full Denture Bases"
L. G. Jordan.....Madison, Ohio

*"Mandibular Movements"
David S. Highkin.....Baltimore, Md.

*"Means of Increasing Efficiency and Minimizing Trauma in Full Dentures"
A. Y. Russel.....Baltimore, Md.

*"The Passing of the Articulator Question, and the Revival of Learning in the Study of Occlusions"
H. I. Rothschild.....Buffalo, N. Y.

*"Reproduction of Natural Teeth with Unusual Mandibular Movements and Similar Edentulous Cases"
Ira G. Nichols.....Champaign, Ill.

Bird's-eye view of Minneapolis.

"Simplified Balanced Bite Technic"
Charles A. Mathis.....Louisville, Ky.

"Models Showing the Use of Established Principles in Balancing Dentures"
Alfred A. Meurer....Milwaukee, Wis.

"Method of Establishing Centric Relationship"
R. D. Temple.....Burt, Iowa

"Practical Selection and Arrangement of Teeth"
R. H. Kingery.....Ann Arbor, Mich.
J. B. Warren.....Ypsilanti, Mich.
G. N. Cannon.....Battle Creek, Mich.
L. C. Schultz.....Detroit, Mich.

"Registration of Maxillary-Mandibular Relation with the Practical Elimination of Tissue Resiliency"
C. J. Stansbery.....Seattle, Wash.

"Casts of Edentulous Mouth Showing Results of Surgical Treatment"
H. F. McCrane.....Omaha, Nebr.

PARTIAL DENTURES
(Section C)

*"Revision of Technic for Porcelain Inlays Using High-Fusing Porcelain"
C. E. Burt.....Los Angeles, Calif.

*"Technic for Removable Bridgework"
James Allan Graham.....
.....San Francisco, Calif.

*"Stationary and Removable Bridgework" (Lecture clinic)
L. W. Doxtater.....New York City

*"Large One-Piece Casting"
F. E. Roach.....Chicago, Ill.

*"Occlusodontia and Restoration"
E. Ray Brownson..Los Angeles, Calif.

*"Scientific Means of Determining the Temperature of Gold and Its Alloys at the Time of Casting by Use of the Thermocouple and Pyrometer; Effects of Overheating; Determining Casting Range of Any Gold Alloy; Fractional Volatilization of Wax Patterns"
Alfred L. Wilkes...Los Angeles, Calif.

*"Practical Application of Some Metallurgic Properties Which, as a Part of Certain Gold Alloys, Influence Their Dental Usefulness"
Merle W. Wilkinson.....
.....Santa Monica, Calif.

"Employing the Cantilever Principles Through Partial Removable Appliances"
O. C. Samphere.....West Allis, Wis.

"Continuous Gum Applied to Partial Dentures and Removable Bridges"
James L. Howard...Hollywood, Calif.

"Something New in a Bar Clasp"
George M. Budlong.....Clermont, Fla.

ORAL SURGERY, EXODONTIA AND ANESTHESIA
(Section D)

"Moving Pictures in Dentistry"
Thomas Conner.....Atlanta, Ga.

"Root Form Variation from the Standpoint of Exodontia"
Don C. Lyons.....Jackson, Mich.

"Anesthesia for Cavity Preparation and Pulp Removal"
F. R. Adams.....New York City

"Alveolectomy"
A. F. Wilbur.....Tacoma, Wash.

Chalmers J. Lyons Club

"Oral Diagnosis"
Chalmers J. Lyons...Ann Arbor, Mich.

"Alveolotomy and Its Uses"
D. H. Bellinger and J. L. Lundberg
.....Detroit, Mich.

"Maxillary and Mandibular Fractures"
L. F. Hill.....Ann Arbor, Mich.

"Treatment of Edentulous Jaw Fractures"
J. O. Goodsell.....Saginaw, Mich.

"Conductive Anesthesia for the Third Branch of the Fifth Nerve"
W. A. Cook.....Detroit, Mich.

"Conductive Anesthesia for the Second Branch of the Fifth Nerve"
G. R. Maitland.....Detroit, Mich.

"Pathologic Conditions of Jaws as Seen by the Roentgen Ray"
J. J. Tolan.....Detroit, Mich.

"Modification of Apicoectomy"
J. O. Beavis.....Ann Arbor, Mich.

"Postoperative Pain"
V. H. Eman.....Grand Rapids, Mich.

*"The Advantage of the Mallet and Chisel in the Extraction of Teeth, and the Reduction of the Alveolar Process"
Boyd S. Gardner.....Rochester, Minn.

*"Osteosarcoma of the Mandible"
E. W. Browning..Salt Lake City, Utah

*"Hypertrophied Tissue: A Report of the Staden Case"
M. R. Howard.....Denver, Colo.

*"Modern Method of Suturing"
J. A. Heidbrink....Minneapolis, Minn.

*"Hypnotic Anesthesia"
Meyer Stein.....New York City

"Removing Impacted Teeth; Complicated Extractions Using Nitrous Oxid and Oxygen Gas"
H. E. Lando and A. J. Schlaefer....
.....Milwaukee, Wis.

"Orthopedic and Surgical Therapy for Deformity of Mandible and Maxilla" (The patient will be presented.)
C. R. Bodenbach.....Milwaukee, Wis.

"Roentgenograms of the Third Molar"
R. M. Pearce.....Davenport, Iowa

"Exodontia and Minor Oral Surgery Simplified by Better Understanding of Principles and Nature of the Parts Operated On" (Models, sections of jaws, etc., will be used in demonstration.)
Sidney L. Tiblier....New Orleans, La.

"Extractions, Followed by Preparation of the Mouth to Receive Full Denture Restorations"
George A. Carr.....Reno, Nev.

"Splint and Headgear for Multiple Maxillary Fracture"
John L. Dunn.....Wheeling, W. Va.

ORTHODONTIA AND PERIODONTIA
(Section E)

*"Operative Technic in Periodontia"
Bruce L. Taylor...Washington, D. C.

*"General and Local Diagnosis as a Means of Determining the Scope of Local Treatment and the Technic of Rational Surgery When Indicated"
Elbert J. Weaver....Milwaukee, Wis.

*"Ultraviolet Rays in the Treatment of Periodontal Diseases"
A. T. Rasmussen.....LaCrosse, Wis.

*"Surgical Treatment of Pyorrhea"
A. W. Ward.....San Francisco, Calif.

*"A Stereoscopic Clinic in Periodontal Disease (Not Pyorrhea)"
Isador Hirschfeld.....New York City

*"Film Showing Gingiva Alveolus Débridement"
Frank S. Kaiser...Los Angeles, Calif.

"Practical Aids for the Orthodontist" (A. A new lingual lock; B. An adjustable all-metal retainer; C. A method of finger-spring attachment for space production and retention; D. Boxing impressions and truing casts.)
L. B. Higley.....Iowa City, Iowa

MOUTH HYGIENE AND PREVENTIVE DENTISTRY
(Section F)

"The Subject of Diet Visualized"
L. R. Kramer.....Hanover, Kan.

RESEARCH AND MISCELLANEOUS CLINICS
(Section G)

*"Source of Calcium Activators"
Weston A. Price.....Cleveland, Ohio

"Calcium Content in Saliva in Relation to Dental Caries"
H. F. Hawkins....Los Angeles, Calif.

"Treatment for Vincent's Infection"
H. W. Burnett.....Fairmont, W. Va.

"Handling of Children with Abscessed Teeth"
L. A. Stark.....Shinnston, W. Va.

COLLEGE CLINICS
(Exhibition Hall—Minneapolis Auditorium)
(Section H)

Baylor University, College of Dentistry, Dallas, Texas.
F. W. Hinds, Dean.

"Radiography and Oral Surgery"
A. C. Sloan

"Prosthetic Dentistry"
Lewis C. Turner

"Oral Pathology"
W. M. Reppeto

"Crown and Bridge Work"
F. W. Hinds

"Crown and Bridge Work"
W. A. Grouws

University of California, College of Dentistry, San Francisco, Calif.
Guy S. Millberry, Dean

"Clinic Representing Student Crown and Bridge Work"
Forrest H. Orton

Chicago College of Dental Surgery, Chicago, Ill.
William H. G. Logan, Dean

"Removal of Mandibular Third Molars Under Local Anesthesia"
P. G. Puterbaugh

"Embryologic Specimens Showing the Development of the Face and Jaws"
Ralph H. Fouser

"Technic of Constructing Porcelain Jacket Crowns"
H. W. Oppice

"Practical Ideas in Dental Prosthesis for the General Practitioner"
Elbert C. Pendleton

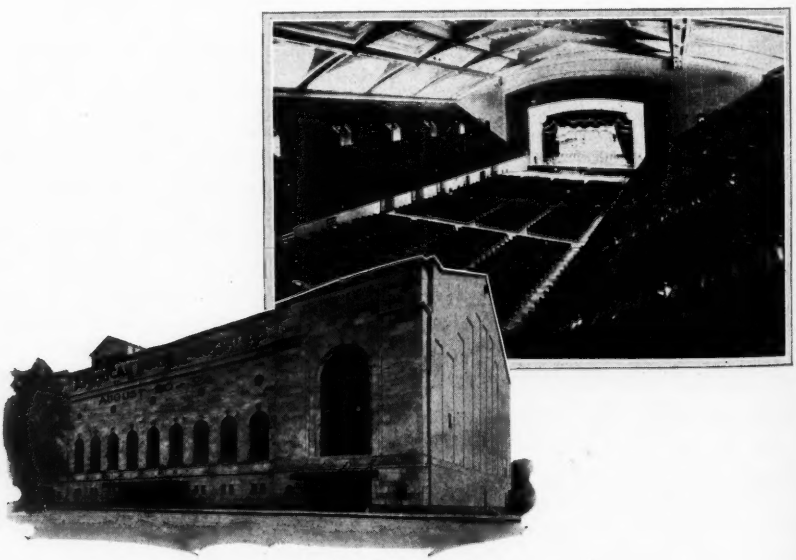
"Histologic Studies of the Teeth and Their Supporting Structures"
Balint Orban (M. D.)

University of Denver, College of Dentistry, Denver, Colo.
A. T. Newman, Dean

"Prosthetics"
M. Swenson

Georgetown University, Washington, D. C.
William N. Cogan, Dean

"Crown and Bridge Work"
Vernon J. Lohr



MINNEAPOLIS AUDITORIUM.

The entire Seventieth Session of the American Dental Association will be held in this building.

"Oral Surgery"
Sterling V. Mead

"Bacteriology and Pathology"
Fernando E. Rodriguez

Harvard University Dental School, Boston, Mass.
LeRoy M. S. Miner, Dean

"Functional Occlusion"
Harvard Study Club

University of Illinois, College of Dentistry, Chicago, Ill.
Frederick B. Noyes, Dean

"Department of Therapeutics"
Edward C. Wach

"Department of Prosthetic Dentistry" (Dentures)
J. S. Kellogg
W. H. Kubacki

"Department of Operative Dentistry"
Victor T. Nylander

Indiana University, School of Dentistry, Indianapolis, Ind.
Frederick R. Henshaw, Dean

"Gold Foil Technic"
John L. Wilson

"Root Canal Technic"
Gerald D. Timmons

"Crown and Bridge Technic"
Ert J. Rogers

"Prosthetic Technic"
Frank C. Hughes

"Inlay Technic"
Ermal C. Baker

University of Iowa, College of Dentistry, Iowa City, Iowa
F. T. Breene, Dean

"Fixed Bridgework"
Ray V. Smith

"A Demonstration of the Low Heat Method of Making the Cast Gold Inlay"
Erling Theon

"The Occurrence of Hutchinson's Teeth in Congenital Syphilis"
C. L. Drain

"End-Results of Supervised Student Orthodontia"
J. Elon Rose

"Stereoscopic Roentgenography"
E. A. Rogers

Lincoln and Lee University—Kansas City Western Dental College, Kansas City, Mo.
R. J. Rinehart, Dean

"Crown and Bridge Work"
J. D. Scott
George Boden

"Prosthetic Dentistry Clinic"
T. H. Walton
C. G. Porter

"Diagnostic Clinic"
R. W. Edwards

University of Louisville, School of Dentistry, Louisville, Ky.
J. T. O'Rourke, Dean

"Casting Technic"
Raymond E. Myers.....Louisville, Ky.

Marquette University, College of Dentistry, Milwaukee, Wis.
Henry L. Banzhaf, Dean

"Dental Histology and Embryology" (Showing lantern slides and miscroscopic specimens.)
William Hopkinson
Mathilda Steinbrecher

"Crown and Bridge Construction" (Teaching models.)
Otto G. Krause

"Operative Dentistry, Operative Technic and Dental Anatomy; Methods of Instruction"
George W. Wilson

"Porcelain Jacket Crown Construction"
Harvey M. Uebele

"Prosthetic Dentistry; Methods of Teaching Full Denture Construction in Prosthetic Technic"
O. M. Dressen
M. G. Cavanaugh

"Exhibit of Students' Work in Dental Drawing"
Edward Drosen

University of Minnesota, College of Dentistry, Minneapolis, Minn.
W. F. Lasby, Dean

Presentation of Teaching Technic and Practical Application

Crown and Bridge Division
A. B. Wells, Chairman
A. A. Pagenkoph
H. Nelson
Carl Otto

Porcelain Restorations
W. D. Vehe, Chairman
R. R. Henry
L. C. McCarthy

Prosthetic Division
Oscar Cooperman, Chairman
R. M. Jernall
R. W. Delton

Orthodontia Division
O. A. Weiss, Chairman
J. O. Baker
H. C. Lawton

University of Minnesota Special Appliances and Machines
Charles E. Larson

Local Anesthesia and Surgery Division
C. A. Griffith, Chairman

"Local Anesthesia" (Technic of injection; instrumentarium and solutions used.)
H. A. Maves
F. H. Hayes

"Oral Surgery" (Models demonstrating technic for the surgical removal of teeth, including impacted teeth, with roentgenograms illustrating the clinic.)
C. E. Herman
E. W. Nelson
C. A. Griffith

"Tic Douloureux" (A new idea as to the probable etiology of trifacial neuralgia, with a method of treatment.)
E. A. McGibbon

"Jaw Fractures" (Models demonstrating appliances used in the treatment of fractures of the maxillae.)
D. E. Ziskin

"Pathology, Diagnosis and Surgery of Disease and Tumors of the Mouth and Jaw" (A large collection of demonstration material including gross and microscopic specimens, casts, roentgenograms and slides; discussion of case records and responsibility of the dentist in the early diagnosis of tumors of the mouth.)
C. W. Waldron
H. G. Worman

Operative Division

"Gold Foil Operations" (Cavity preparation; manipulation of gold; finishing filling.)

"The Gold Inlay" (Cavity preparation; wax pattern making; casting; finishing.)

"Children's Dentistry" (Cavity preparation; models showing variation in cases.)
J. M. Walls, Chairman
M. O. Pattridge
J. M. Little
R. S. Maybury
L. W. Thom
H. C. Wittich

Oral Hygiene and Dental Pathology
"Early Loss of Teeth and Its Relation to Periodontal Disease"
Dorothea Radusch

"Vincent's Infection and Its Treatment"
D. R. Clark

"Surgical Treatment in Periodontia"
Raymond E. Johnson

"Gingival and Other Oral Manifestations of Systemic Disease"
Harold F. Wahlquist

"Roentgenology, An Aid in Oral Diagnosis"
Peter J. Brekhus
Paul G. Lilja
George A. Montelius

University of Minnesota Hospital
"Pyorrhea and Other Diseased Conditions of the Oral Cavity as Related to the General Systemic Conditions" (A table clinic.)
W. A. Grey

North Pacific College, School of Dentistry, Portland, Ore.
Louis J. Fitzpatrick, Dean

"Some Fundamentals of Roentgenographic Technic and Interpretation"
Henry C. Fixott

"The Possibilities of Facial Contour Restoration and Esthetics in Full Denture Construction"

Everett M. Hurd

"Practical Partial Denture Construction Pertaining Especially to Assembled Tissue Bearing Appliances"

David T. Chase

College of Physicians and Surgeons of San Francisco, San Francisco, Calif.

A. R. McDowell, Dean

"Crown and Bridge Work"

B. C. Kingsbury

"Inlays and Castings"

George A. Selleck

"Orthodontia Technic"

Frederick T. West

"Operative Dentistry"

A. R. McDowell

"Dental Porcelain Technic"

Thomas H. Forde

University of Southern California, College of Dentistry, Los Angeles, Calif.

Lewis E. Ford, Dean

"Dental Anatomy as the Foundation for all Dental Operative Procedures"

W. P. Harrison

"Operative Technic; Prosthetics; Crown and Bridge Work; Ceramics"

Members of teaching staff of the University of Southern California, College of Dentistry

SEVENTH DISTRICT CLINICS

(Exhibition Hall, Minneapolis Auditorium.)

OPERATIVE DENTISTRY

(Section A)

Group Clinics

The G. V. Black Dental Club of St. Paul

J. W. S. Gallagher, Director.....
.....Winona, Minn.

(This group will demonstrate the making of gold foil restorations in different classes of cavities in teeth for patients from the beginning of the cavity outline to the finishing of the operation. Directly in front of each chair will be a table clinician, who will use models and demonstrate the various steps of the operation.)

"Gold Foil Operation: Mesial or Distal Surface of an Upper Incisor"

Operator

C. A. Hintz.....New Ulm, Minn.

Demonstrator

W. R. Brooks.....Colfax, Wis.

"Gold Foil Operation: Mesioincisal or Distoincisal Surface of an Upper Incisor or Cuspid"

Operator

C. P. Peterson.....Mankato, Minn.

Demonstrator

O. C. Zieger.....Owatonna, Minn.

"Gold Foil Operation: Mesioclusal Surface of an Upper Bicuspid"

Operator

C. A. Searl.....Owatonna, Minn.

"Gold Foil Operation: Mesioclusal Surface of an Upper First Molar"

Operator

C. F. Clark.....Menomonie, Wis.

Demonstrator

F. S. James.....Winona, Minn.

"Gold Foil Operation: Occlusal Surface of a Lower Molar"

Operator

J. H. Burns.....Hutchinson, Minn.

Demonstrator

M. H. Thornton.....St. Paul, Minn.

"Preparation of Gold Foil for Daily Use" (Showing method of making pellets and cylinders.)

Demonstrator

E. Mihleis.....Ellsworth, Wis.

"Photographic Display of Sections of Teeth" (Table Clinic.)

Demonstrator

Bert R. Carlson.....Minneapolis, Minn.

Minneapolis Group Clinic
Crown and Bridge Work
Herman A. Maves, Director

"Preparations of Crown and Bridge Abutments on Vital Teeth"

R. A. Ulvestad

"Preparation of Bridge Abutments on Vital Teeth That Have Previously Carried Porcelain Jacket Crowns"

Harvey C. Samuels

"Crown and Bridge Preparations on Porcelain Teeth with Castings Made by Expansion Technic"

F. M. Streitz

"Expansion of Waxes; Investing; Elimination of Wax; Elimination of Moisture; Castings"

A. Selberg

"Selection of Facings for Pontics with Due Regard to Color, Form and Arrangement. Method of Taking Impressions for Fixed Bridgework"

C. C. Sparrow

"Construction of Pontics"

B. A. Anderson

"Symmetry and Assembly of Bridges Including Stressbreaking"

W. H. Card

"Finished Cases of Fixed Bridges"

Charles A. Wiethoff

"Finished Cases of Fixed Bridgework"

L. W. Thom
George D. Estes

"McCollum Attachments in Removable Bridgework"

C. W. Holtzman

Individual Clinics

"Reconstruction Case of Balanced Occlusion, Two Years Old"

H. B. Horwitz.....St. Paul, Minn.

"Large Castings by the Indirect Method"

Wilbur A. Carlson.....Detroit, Minn.

"Thin, Rigid Three-Quarter Crown and Preparations"

Arthur E. Skon.....St. Paul, Minn.

"Inlay Restorations Including an Anterior Six-Tooth Implanted Bridge"

B. L. Maertz.....Olivia, Minn.

"Fixed Bridgework Featuring Porcelain Tips"

A. P. Schouweiler.....Redwing, Minn.

"Amalgam Fillings"

John A. Maker.....Duluth, Minn.

"Esthetics in Anterior Gold Work"

M. G. Walls.....St. Paul, Minn.

Monson Research and Clinic Club
H. B. Washburn, Director, St. Paul, Minn.

Reconstruction of Natural Teeth

"Diagnosis of Various Types of Unbalanced Natural Occlusion Showing Each Step in the Technic for Correction, Demonstrating the Balanced Occlusal Guide"

C. K. Bird.....St. Paul, Minn.

"Explanation of the Principles and Mechanics of the Monson Spherical Theory of Occlusion"

W. K. Haven.....Minneapolis, Minn.
C. W. Benson.....Duluth, Minn.

"Tooth Arrangement and Esthetics"

M. O. Nelson.....St. Paul, Minn.

"Correction of Occlusal Inaccuracy by Grinding and Milling Finished Dentures"

H. D. Aldrich.....St. Paul, Minn.

Chair Clinics

"Gold Foil Fillings"

W. R. Clack.....Clear Lake, Iowa

"Gold Inlay"

W. H. Chapman.....Burlington, Iowa

Table Clinics

"Some Mesioclusodistal Castings"

John W. Marsh.....Keokuk, Iowa

"Proximal Inlays"

Warren G. Hayes.....Lansing, Iowa

"Controlling the Desired Amount of Expansion for Wax Patterns in Casting Inlays"

C. A. DeLano.....Cedar Rapids, Iowa

"Porcelain Jacket Crown"

C. M. Work.....Ottumwa, Iowa

"Porcelain Inlays (Gingival Third)"

E. H. Ford.....Des Moines, Iowa

"Root Canal Technic"

J. B. Kennedy.....Des Moines Iowa

"Ideas for Full Porcelain Pontics"

Hardy F. Poole.....Mason City, Iowa

"Bridges with McBoyle Abutments Which Have Been in Service for Seven Years"

R. F. Beck.....Webster City, Iowa

"Practical Everyday Uses for Low Fusing Porcelain and Stains, Using an Inexpensive Furnace"

C. E. Westwood.....Sioux City, Iowa

"First Known Casting Apparatus for Casting Inlays" (Originated by Dr. Philbrook in 1895, and shown for the first time at the meeting of the Iowa State Dental Society in 1897.)

B. F. Philbrook.....Sioux City, Iowa

"Root Canal Therapy"

J. V. Conzett.....Dubuque, Iowa

Group Clinics

"Gold Foil Operations"

Woodbury Study Club of Iowa and Nebraska

Charles E. Woodbury.....
.....Council Bluffs, Iowa

Demonstrator

Chair Clinics

Class 1

H. D. Coy.....Hamburg, Iowa
W. F. Hemphill.....Blair, Nebr.
G. L. Spencer.....Lincoln, Nebr.

Class 2

H. A. Merchant.....Omaha, Nebr.
F. W. Schaefer.....Omaha, Nebr.
H. A. True.....Des Moines, Iowa

Class 3

F. H. Waters.....Ames, Iowa
J. H. Davis.....Sioux City, Iowa
W. H. Kenderdine.....Sioux City, Iowa

Class 4

L. E. Meyers.....Omaha, Nebr.
L. S. Peek.....Fontanelle, Iowa
H. E. Latcham.....Sioux City, Iowa

Table Clinics

W. L. Kling.....Wahoo, Nebr.
C. E. Heyne.....Lyons, Nebr.
H. G. Bolks.....Sioux City, Iowa
F. J. Despecher.....Omaha, Nebr.

Group Clinics

"Construction of a Fixed Bridge with Porcelain Pontics"

Representatives of the G. V. Black Dental Study Club of Des Moines, Iowa.

1. "Diagnosis; Articulation and Occlusion; Abutment Preparation"

   C. M. Kennedy

2. "Abutment Impressions; Wax Manipulation; Wax Restoration for Abutments and Pontics"

   Charles H. Henshaw

3. "Selecting and Preparing the Facings; Porcelain Manipulation; Porcelain Restorations"

   Earl W. Howard

4. "Wax Investing; Wax Elimination; Preparation of the Gold; Castings"

   Emory O. West

5. "Bite and Impressions; Bridge Assembly; Investing and Soldering; Checking Occlusion; Finishing Bridge"

   R. A. Sears

Propertyman

Jerry W. Peters

Cast Gold Inlays Presented by the Study Club of Waterloo, Iowa

(The technic of the various steps will be demonstrated and the completed case will be shown.)

1. "Cavity Preparation"

   C. N. Shane
   T. R. McCoy

2. "Wax Patterns"

   L. F. Bailey
   C. E. Carl

3. "Investing"

   C. R. Hoxie
   C. R. Bruggeman

4. "Casting"

   J. E. Hemingway
   E. H. Kromer

5. "End Results"

   L. C. Hemsworth

Group Clinics

Cast Gold Inlay Clinic

Representatives of the Cedar Rapids Dental Society Group

H. E. Hanson, Chairman

(A technic will be demonstrated showing the process of making a cast gold inlay from the beginning to the setting of the inlay. The actual steps will be carried through; the wax patterns will be carved and invested; and the castings will be made and finished.) "(1) Cavity Preparation; (2) Wax Patterns; (3) Investing; (4) Eliminating Wax; (5) Casting; (6) Etching; (7) Finished Inlays"

C. N. Booth.....Cedar Rapids
C. L. Layton.....Cedar Rapids
D. L. Morrissey.....Cedar Rapids
George Reid.....Mt. Vernon
A. N. Humeston.....Cedar Rapids
John J. Booth.....Marion
L. A. Kessler.....Cedar Rapids
C. V. Lehman.....Cedar Rapids
C. F. Huber.....Cedar Rapids
John Scholten.....Cedar Rapids

Propertyman
E. A. Spraker.....Cedar Rapids

FULL DENTURES

(Section B)

Group Clinic

Monson Research and Clinic Club

"Result of Facial Restoration by Proper Full Denture Construction" (The patient will be presented.)

George S. Monson.....St. Paul, Minn.

Steps in Full Denture Technic

"Impression Technic and Preparation of Casts for Baseplates"

C. H. Jamieson.....Frederic, Wis.

"Registration of Central Occlusion, Transfer and Mounting on the Monson Instrument, Demonstrating the Compensating Arc"

Abner G. Bjorklund....St. Paul, Minn.

"Teeth Arrangement and Esthetics"

M. O. Nelson.....St. Paul, Minn.

"Correction of Occlusal Inaccuracy by Grinding and Milling Finished Dentures"

H. D. Aldrich.....St. Paul, Minn.

"Points to Consider in Choice of Denture Material with Regard for Appearance and Hygiene"

W. D. Taylor.....Newark, N. J.

Minneapolis Group Clinic

V. W. Davis, Director

"Mounting Full Denture Case on the "Balancer" Without a Face-Bow"

V. W. Davis.....Minneapolis, Minn.

"Impression Technic—Full Upper and Lower Dentures; Practical Case Showing Color Harmony in Full Dentures"

H. A. Munns.....Minneapolis, Minn.

"Models and Patient Showing Dr. Neil's Teachings"

H. L. Harris.....Minneapolis, Minn.

"A Definite Technic for Establishing Central Occlusion"

J. F. Ralston.....Minneapolis, Minn.

"Packing a Denture Ready for Vulcanizer"

H. W. Rieke.....Minneapolis, Minn.

"Staining Teeth in Denture Cases"

C. W. Kelsey.....Minneapolis, Minn.

Individual Clinics

"Pressure Equalization and Its Application to the Impression Technic for Lower Dentures"

Benjamin F. Sahr....Hutchinson, Minn.

"Balanced Full Upper and Lower Denture Construction." (Showing case with patient present, in both rubber and the new materials used for denture work, with a comparison of the two types, including impression work.)

M. M. Zeches.....Winona, Minn.

"Compound Impressions for Full Dentures Using a Vulcanite Tray"

C. S. Foster.....Newton, Iowa

Group Clinics

Full Denture (Neil Technic)

Des Moines, Iowa, Prosthetic Club

(This group will endeavor to cover every phase of full denture construction from mouth diagnosis to and including the showing of the completed practical case.)

"Anatomy"

Emory O. West, Chairman

"Diagnosis"

B. A. Weber

"Upper Impression"

F. N. Ralston

"Lower Primary Impression"

W. J. Cameron

"Trial Plates, Post Damming, Centric Occlusion"

N. R. Yenter

"Arrangement and Articulation of Teeth Set to Centric Occlusion Only; Protrusive Bites and Adjusting Condyle Paths"

O. E. Hoffman

"Rebasing the Lower Denture"
Ralph A. Sears

"Balancing Occlusion in the Completed Case: (a) Centric Relation; (b) Facebow Record; (c) Proving Centric Relation; (d) Protrusive Check Bites; (e) Proving Condyle Registration; (f) Milling the Case"
F. E. Thornton

Propertyman
Peter P. Laude

PARTIAL DENTURES
(Section C)

Minneapolis Group Clinic
R. R. Jones, Director

"Partial Denture Design"
H. E. Turnquist

"Partial Impressions Plaster Technic"
L. M. Ingebrigtsen

"Special Attachments for Partial Dentures"
W. H. MacNeil

"Gold Partial Dentures"
Harry A. Tinker

"Types of Clasp Attachments in Partial Denture Service"
D. D. Geddes

"A Method of Taking Impressions for Partial Dentures Where Teeth Are to Be Extracted After Impression Is Taken." (Showing that the finished place can be slipped to place without touching a contact point and the contact points will always be correct.)
F. S. Meyer

"Partial Denture Retainers" (Showing clasp design; technic for impression taking for clasps; stressbreaker attachments where posterior teeth are missing.)
R. R. Jones

"Practical Case: Patients with Malformed Maxilla Restored to Nearly Normal Contour by Removable Appliance"
V. D. Whitaker

"Impressions: Casts of Cleft Palates, Cleft Lip and Restorations"
John Davern.....St. Paul

ORAL SURGERY, EXODONTIA AND ANESTHESIA
(Section D)

State of Minnesota Exodontia Group
V. W. Dedon, Director, St. Paul, Minn.

"Use of Carbon Dioxid with Nitrous Oxid"
H. B. Clark.....St. Paul, Minn.

"Use of Ether in Obstreperous Cases, and a New Method of Tying Sutures"
Harvey D. Barnett.....St. Paul, Minn.

"Lower Impacted Third Molar Technic"
L. J. Salisbury.....St. Paul, Minn.

"Some Interesting Cases" (Lantern slides)
V. W. Dedon.....St. Paul, Minn.

"Interesting Third Molar Cases"
E. D. Bettenhausen.....Duluth, Minn.

"Treatment of Trench Mouth"
G. A. Hagberg.....Minneapolis, Minn.

"Control of Postoperative Hemorrhage"
L. M. Cruttenden.....St. Paul, Minn.

"Technic for the Removal of the Lower First Molar"
K. L. Rice.....Duluth, Minn.

"Nitrous Oxid and Oxygen"
J. A. Heidbrink.....Minneapolis, Minn.

"Severing of Teeth by Mallet and Chisel to Facilitate Their Removal"
Boyd S. Gardner.....Rochester, Minn.

"Use of the Chisel in the Extraction of Teeth"
Louis T. Austin.....Rochester, Minn.

"Rules to Be Observed for Correct Roentgenograms of Impacted Teeth"
C. F. Sweet.....Minot, N. D.

Local Anesthesia and Minor Oral Surgery

Minneapolis Group Clinic
D. E. Ziskin, Director

Local Anesthesia

"Demonstration of Technic of Injections in the Superior Maxilla"
C. A. Griffith

"Demonstration of Technic of Injections of the Mandible"

William McDougall

(Discussion of instrumentarium and solutions used will be included in this section.)

Minor Oral Surgery

(Models demonstrating the technic for the surgical removal of all teeth as well as impacted teeth will be displayed, and a discussion of the restorations used in the cases surgically treated will follow. Roentgenograms will be used to further illustrate the clinic.)

C. E. Herman
E. W. Nelson

"Vincent's Infection and Tic Douloureux" (A new idea as to the probable etiology of trifacial neuralgia together with a method of treatment will be presented. A discussion of the probable etiology and a method of treatment of Vincent's infection will be followed by microscopic demonstration of smears. Routine office treatment of this condition will be shown, with suggestions for home treatment.)

E. E. McGibbon

"Jaw Fractures" (A group of models demonstrating the various appliances used in the treatment of fractures of the maxillæ will be shown.)

D. E. Ziskin

Dental Roentgenography

Minneapolis Group Clinic
H. Holliday, Director

"Physics of the Roentgen Ray"

H. H. Holliday

"Chemistry of the Roentgen Ray"

Lehman Wendell

"Interpretation"

P. J. Brekhus

"Simple Method of Filing Roentgenograms"

Lorin B. Hodgson (Breckenridge)

Iowa Group Clinic

"Use of Profile Roentgen Ray Pictures as a Check in Restoring Facial Contour in Making Artificial Dentures"

Alvin L. Miller....Charles City, Iowa

"Roentgen Ray Pictures Showing Roots Under Dentures and Bridges; Methods of Removing Roots Without Injuring or Removing Bridge, and Report on the Systemic Improvement in Patient"

Herbert B. Brock....Des Moines, Iowa

"Simple Method of Taking Impression for the Mechanical Closure of Cleft Palate"

C. W. Siefkin.....Rolfe, Iowa

"Diagnosis and Case Histories"

J. A. Bliss.....Sioux City, Iowa

"The Roentgen Ray in Orthodontia" (Showing third molar, cuspid and other impactions and progressive tooth movement, with models before and after treatment.)

C. W. Bruner.....Waterloo, Iowa

ORTHODONTIA AND PERIODONTIA

(Section E)

Minnesota Group Clinic

Max E. P. Ernst, Director...St. Paul, Minn.

"Early Manifestations of Developing Malocclusion" (Demonstrating: (a) Lack of development in deciduous dentures; (b) malrelation of dental arches in deciduous dentures; (c) abnormalities in mixed dentures and in permanent dentures resulting from abnormal development of deciduous dentures.)

L. J. Sykora.....Duluth, Minn.

"Malocclusions Resulting from Premature Extraction of Deciduous Teeth" (Demonstrating by means of plaster casts and roentgenograms, migration of teeth, both deciduous and permanent, where deciduous teeth have been lost at an early age; demonstrating also methods employed to guard against such migration of teeth.)

L. W. Gange.....St. Paul, Minn.

"Malocclusions Resulting from or Complicated by: (a) Congenital Absence of Permanent Teeth. (b) Supernumerary Teeth. (c) Transposed teeth" (Demonstrating abnormalities due to these causative factors; also necessity for routine roentgenographic examinations in orthodontic practice.)

A. L. Thomas.....Minneapolis, Minn.

"Malocclusions Resulting from or Complicated by Unerupted Teeth and Impacted Teeth" (Demonstrating abnormalities due to these causative factors; also methods employed in treatment of these cases and results obtained in treatment.)

Edward Gilmer.....St. Paul, Minn.

"Malocclusions Resulting from Abnormal Muscular Habits" (Demonstrating by means of plaster casts malformation of dental arches due to: (a) thumb sucking and finger sucking; (b) lip habits; (c) tongue habits; (d) posture habits; (e) abnormal breathing.)

Esther N. Farrand..Minneapolis, Minn.

"Treatment of Neutroclusion or Class 1 Cases" (Demonstrating: (a) principles involved in treatment of this class of malocclusion; (b) appliances ordinarily used in treatment; (c) results obtained in treatment.)

Walter Hyde.....Minneapolis, Minn.

"Treatment of Distoclusion or Class 2 Cases" (Demonstrating: (a) principles involved in the treatment of this class of malocclusion; (b) appliances ordinarily used in treatment; (c) results obtained in treatment.)

Guy B. Steadman.....St. Paul, Minn.

"Treatment of Mesioclusion or Class 3 Cases" (Demonstrating: (a) principles involved in the treatment of this class of malocclusion; (b) appliances ordinarily used in treatment; (c) results obtained in treatment.)

J. B. Kohagen.....Duluth, Minn.

"Orthodontia from General Practice"

Paul Hagan.....Crookston, Minn.

"Pyorrhea and Other Disease Conditions of the Oral Cavity as Related to General Systemic Conditions"

W. A. Grey.....St. Paul, Minn.

"A Toothbrush Technic for Pyorrhea Prevention"

W. J. Charters.....Des Moines, Iowa

"Space Retainers: (a) Who Should Make Them — Dentist or Orthodontist? (b) Where Indicated. (c) Various Kinds and the Materials Used. (d) Care of Same While in the Mouth."

Howard D. Keeler...Des Moines, Iowa

"Construction and Use of a Removable Orthodontic Appliance With an Adaptation of the Inclined Plane"

P. H. Belding.....Waucoma, Iowa

"Technic of Band Construction for Regulating Appliances"

A. B. Thompson.....Des Moines, Iowa

"Treatment of Periodontoclasia by Instrumentation"

E. A. Schrader.....Independence, Iowa

RESEARCH AND MISCELLANEOUS

(Section G)

Minneapolis Group Clinic

W. C. Naegeli, Director

Children's Dentistry

"Handling of Children"

Thomas J. Mee

"Preventive Dentistry"

J. T. Cohen

"Filling Deciduous Teeth"

Kenneth W. Miner

"Extraction of Children's Teeth"

Harry I. Miner

"Retention and Expansion of Spaces Caused by Loss of Teeth"

R. L. Dunton

"Precautions in Care of Permanent Teeth"

F. C. Obermeyer

"Special Phases of Children's Dentistry"

T. P. Ryan

"Children's Dentistry"

H. C. Wittich (St. Paul)

"Vincent's Infection"

T. L. Stickney (Crookston)

"Common Simplified Blood Tests of Practical Value to the Dentist"

Irwin A. Epstein (St. Paul)

MISCELLANEOUS CLINICS

"Small Facts About Inlay Technic That Make Big Results"

D. R. Miller.....Bird Island, Minn.

"The Three-Quarter Crown"
H. C. Dressel.....Silverlake, Minn.

"Some Anthropologic Phases of Dental Research"
G. A. Montelius....Minneapolis, Minn.

"Artificial Nose Restoration"
Roy C. Siple.....Cherokee, Iowa

"Testing Physical Properties of Platinum Alloys"
John F. Dwight, Jr..Des Moines, Iowa

"A New Device to Prevent Thumb Sucking"
Wesley C. Darby...Des Moines, Iowa

"Practical Dentistry for Children"
Max U. Wilson and G. H. Hospers
..... Waterloo, Iowa

THE MINNEAPOLIS SESSION

MOTION PICTURE PROGRAM

August 20

10:00 a. m. to 12:00 m.

"Health Twins at Work"
American Social Hygiene Association
.....New York City

"Working For Dear Life"
Metropolitan Life Insurance Co.....
.....New York City

"Your Mouth"
Edwin N. Kent.....Boston, Mass.

"The Dental Hygienists"
Alfred C. Fones.....Bridgeport, Conn.

"Through Life's Window"
Minnesota State Health Department.
.....St. Paul, Minn.

"The Epithelial Inlay"
U. S. Army Medical Museum, Washington, D. C.

2:00 to 5:00 p. m.

"Tommy Tucker's Tooth"
Thomas B. McCrum..Kansas City, Mo.

"Sun Babies"
Children's Bureau, Washington, D. C.

"He Who Laughs Last"
N. Y. Tuberculosis and Health Association, New York City.

"Clara Cleans Her Teeth"
Thomas B. McCrum..Kansas City, Mo.

"The Reward of Courage"
American Society for the Control of Cancer, New York City.

"Principles of First Aid"
U. S. Bureau of Mines, Washington, D. C.

"Tommy's Troubles"
New York Tuberculosis and Health Association, New York City

"Science of Life I, II, III, IV"
U. S. Public Health Service, Washington, D. C.

August 21

2:00 to 5:00 p. m.

"The Reward of Courage"
American Society for the Control of Cancer, New York City.

"Your Mouth"
Edwin N. Kent.....Boston, Mass.

"Working for Dear Life"
Metropolitan Life Insurance Co., New York City.

"Sun Babies"
Children's Bureau, Washington, D. C.

"Tommy's Troubles"
New York Tuberculosis and Health Association, New York City.

"Principles of First Aid"
U. S. Bureau of Mines, Washington, D. C.

"Tommy Tucker's Tooth"
Thomas B. McCrum..Kansas City, Mo.

"Science of Life V, VI, VII, XII"
U. S. Public Health Service, Washington, D. C.

August 22

9:00 a. m. to 12:00 m.

"Science of Life, I, II, III, IV"
U. S. Public Health Service, Washington, D. C.

"Sun Babies"
Children's Bureau, Washington, D. C.

"Clara Cleans Her Teeth"
Thomas B. McCrum..Kansas City, Mo.

"Health Twins at Work"
American Society of Social Hygiene, New York, N. Y.

"Pasteur I, II, III, IV"
U. S. Department of Agriculture, Washington, D. C.

2:00 to 5:00 p. m.

"Principles of First Aid"
U. S. Bureau of Mines, Washington, D. C.

"The Reward of Courage"
American Society for Control of Cancer, New York City.

"Tommy Tucker's Tooth"
Thomas B. McCrum..Kansas City, Mo.

"He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.

"Your Mouth"
Edwin N. Kent.....Boston, Mass.

"Working for Dear Life"
Metropolitan Life Insurance Co., New York City.

"Tommy's Troubles"
New York Tuberculosis and Health Association, New York City.

"Mouth Hygiene for School Children"
Alfred C. Fones.....Bridgeport, Conn.

"Posture"
U. S. Children's Bureau, Department of Labor, Washington, D. C.

August 23

9:00 a. m to 12:00 m.

"Science of Life V, VI, VII, XII"
U. S. Public Health Service, Washington, D. C.

"Tommy's Troubles"
New York Tuberculosis and Health Association, New York City.

"Clara Cleans Her Teeth"
Thomas B. McCrum..Kansas City, Mo.

"Reward of Courage"
American Society for the Control of Cancer, New York City.

"Overweight"
Metropolitan Life Insurance Co., New York City.

"He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.

"Tommy Tucker's Tooth"
Thomas B. McCrum..Kansas City, Mo.

"Working for Dear Life"
Metropolitan Life Insurance Co., New York City.

2:00 to 5:00 p. m.

"Pasteur I, II, III, IV"
U. S. Department of Agriculture, Washington, D. C.

"Your Mouth"
Edwin N. Kent.....Boston, Mass.

"A Fortunate Accident"
American Society for the Control of Cancer, New York City.

"Training Hospital Corpsmen Including Dental Technicians in the Navy Medical Schools"
U. S. Navy Medical School, Washington, D. C.

"Sun Babies"
Children's Bureau, Washington, D. C.

"He Who Laughs Last"
New York Tuberculosis and Health Association, New York City.

"Clara Cleans Her Teeth"
Thomas B. McCrum..Kansas City, Mo.

LUNCH CLUBS

August 20

Minneapolis Torch Club, 12:15 p. m., Radisson Hotel. A. H. Hipple, Omaha, Nebr.

August 21

Exchange Club, Leamington Hotel. C. J. Hollister, Harrisburg, Pa.

Kiwanis Club, 12:15 p. m., Nicollet Hotel. J. P. Buckley, Los Angeles, Calif.

Minneapolis Business Men's Association, 12:15 p. m., Radisson Hotel (Gold Room). Arthur H. Merritt, New York City.

August 22

Business Forum, 12:15 p. m., Donaldson's (Cabin Room). Arthur D. Black, Chicago, Ill.

Lions Club of Minneapolis, 12:15 p. m., Radisson Hotel (Gold Room). Rae Proctor McGee, Los Angeles, Calif.

Optimist Club, 12:15 p. m., Leamington Hotel. E. L. Pettibone, Cleveland, Ohio.

August 23

Commonwealth Club, 12:15 p. m., West Hotel. DeLos L. Hill, Atlanta, Ga.

Conopus Club, 12:15 p. m., Minneapolis Athletic Club. F. B. Rhobotham, Chicago, Ill.

Cosmopolitan Club, 12:15 p. m., Nicollet Hotel. J. V. Conzett, Dubuque, Iowa.

Grafil Club, 12:15 p. m., Y. M. C. A. Henry Gillette, New York City

Professional Men's Club, 12:15 p. m., Donaldson's (Japanese Room). C. N. Johnson, Chicago, Ill.

August 24

American Business Club, 12:15 p. m., Donaldson's (Japanese Room). F. B. Noyes, Chicago, Ill.

Cooperative Club, 12:15 p. m., Radisson Hotel (Gold Room). Thomas P. Hinman, Atlanta, Ga.

Rotary Club of Minneapolis, 12:15 p. m., Nicollet Hotel. Donald McKay Gallie, Chicago, Ill.

RADIO PROGRAM

August 20

Station WHDI, 8:30 a. m., Harvey J. Burkhart, Rochester, N. Y.; WCCO, 1:20 p. m., Roscoe H. Volland, Iowa City, Iowa; KSTP, 1:50 p. m., Hart J. Goslee, Chicago, Ill.; WRHM, 2:00 p. m.; WRHM, 5:50 p. m., Lon W. Morrey, Springfield, Ill.; KSTP, 6:10 p.m., Frederick A. Bricker, Hollywood, Calif.; WRHM, 8:00 p. m., Percy R. Howe, Boston, Mass.; WHDI, 8:00 p. m., Thaddeus P. Hyatt, New York City.

August 21

Station WHDI, 8:30 a. m., George H. Wandel, Chicago, Ill.; WCCO, 1:20 p. m., F. R. Henshaw, Indianapolis, Ind.; KSTP, 1:50 p. m., R. J. Rinehart, Kansas City, Mo.; WRHM, 2:00 p. m., P. G. Puterbaugh, Chicago, Ill.; WRHM, 5:50 p. m., Weston A. Price, Cleveland, Ohio; KSTP, 6:10 p. m., Robin Adair, Atlanta, Ga.; WRHM, 8:00 p. m., Russell W. Bunting, Ann Arbor, Mich.

August 22

Station WHDI, 8:30 a. m., C. J. Hollister, Harrisburg, Pa.; WCCO, 1:20 p. m., Henry L. Banzhaf, Milwaukee, Wis.; WRHM, 2:00 p. m., W. R. Wright, Jackson, Miss.; WRHM, 5:50 p. m., Frederick B. Noyes, Chicago, Ill.; WRHM, 8:00 p. m., Thomas C. Bonney, Aberdeen, S. D.; KSTP, 6:10 p. m., R. S. Towne, Bismarck, N. D.

August 23

Station WHDI, 8:30 a. m., E. L. Pettibone, Cleveland, Ohio; WCCO, 1:20 p. m., Donald M. Gallie, Chicago, Ill.; KSTP, 1:50 p. m., C. N. Johnson, Chicago, Ill.; WRHM, 2:00 p. m., E. H. Hatton, Chicago, Ill.; WRHM, 5:50 p. m.; WCCO, 7:00 p. m.; WRHM, 8:00 p. m.

Girls' Camps

Tuesday, August 21

Camp Tandoona, 10:15 a. m.
Gillette Hayden, Columbus, Ohio.

Thursday, August 23

Elizabeth Lyman Lodge, 10:15 a. m.
Gladys Eyrich, Jackson, Mich.

Boys' Camp

Camp Tonkawa, 1:30 p. m.
Russell W. Bunting, Ann Arbor, Mich.

ANNOUNCEMENTS

PAST PRESIDENTS LUNCHEON

The luncheon for the Past Presidents of the American Dental Association will be held August 21, at 12:30 p. m., at the Radisson Hotel, Minneapolis.

MOUTH HYGIENE LUNCHEON

The annual Mouth Hygiene Luncheon of the American Dental Association will be held at the Curtis Hotel, Wednesday, August 22. Tickets, $1.50.

MINNESOTA STATE DENTAL ASSOCIATION LUNCHEON

A luncheon will be given the Delegates and Officers of the American Dental Association by the Minnesota State Dental Association, August 20, at 12 m., at the Radisson Hotel, Minneapolis.

SCIENTIFIC FOUNDATION AND RESEARCH COMMISSION, A. D. A.

The Scientific Foundation and Research Commission of the American Dental Association will meet at 2:00 p. m., Sunday, August 19, at the Radisson Hotel, Minneapolis.

TRANSPORTATION

An Identification Certificate will be sent to each member of the American Dental Association, approximately one month in advance of the meeting. When properly filled out and presented to the local railway agent, it will authorize him to sell a round trip

ticket to the member for himself and dependent members of his family, at one and one-half fares. Selling dates for these tickets will be August 15, 16, 17, 18, 20 and 21, with return limit, August 30.

JOHN R. BARTIZAL, *Acting Chairman,*
Transportation Committee

ATTENTION—GOLFERS

The annual tournament of the American Dental Golf Association will be held in Minneapolis, August 19-20, beginning with the golf banquet and Calcutta Pool, August 19, at 6:30 p. m. Monday. August 20. The big tournament will be held at the Golden Valley Club. The championship game will be played off at the Interlachen Country Club. Life membership in the Golf Association is $3. Apply to

E. W. BROWNING,
921 Boston Bldg.,
Salt Lake City, Utah

TRAPSHOOTERS

The Trapshooters of the American Dental Association will hold their annual shoot, Tuesday, August 21, at 2:00 p. m., at the Twin City Shooting Association Grounds, Minneapolis. Those wishing to participate should register on arrival in Minneapolis. All standard makes of shells will be sold on the grounds. Cups and various prizes have been arranged for. The program will include a 100 target event, 16 yard rise.

A. C. ENGEL, *Secretary,*
930-934 Arcade Bldg.,
St. Louis, Mo.

MEETING OF STATE SOCIETY AND A. D. T. A. REPRESENTATIVES

Representatives of the state dental societies and of the American Dental Trade Association will meet at 4:00 p. m., Sunday, August 19, at the Radisson Hotel, Minneapolis.

FEDERATION OF AMERICAN WOMEN DENTISTS

The seventh annual meeting of the Federation of American Women Dentists will be held at the Plaza Hotel, Minneapolis, Monday, August 20. Registration will begin at 10:00 a. m. A business session will be held in the afternoon, beginning at 2 o'clock. At 5 p. m., transportation will be available for a short drive over the boulevards, ending at one of the country clubs, where a banquet will be served. Reservations may be made with Dorothea F. Radusch, 909 Metropolitan Bldg., Minneapolis.

MARY B. MEADE, *President,*
Carmi, Ill.

WILHELMINA YERETSKY, *Secretary,*
26 Sheldon Ave., S. E.,
Grand Rapids, Mich.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The American Academy of Restorative Dentistry will meet at the Minneapolis Club, 729 Second Avenue South, Minneapolis, August 17-18.

RALPH L. MORRISON, *Sec'y-Treas.,*
The Rochambeau,
Washington, D. C.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The tenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held at the Radisson Hotel, Minneapolis, August 17-18.

HARRY BEAR, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

AMERICAN ACADEMY OF PERIODONTOLOGY

The fifteenth annual meeting of the American Academy of Periodontology will be held at the Nicollet Hotel, Minneapolis, August 16-18. The annual banquet will be given Saturday evening, August 20.

JUSTIN D. TOWNER, *President,*
Exchange Bldg.,
Memphis, Tenn.

J. HERBERT HOOD, *Secretary,*
Hanna Bldg.,
Cleveland, Ohio

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The next meeting of the National Association of Dental Examiners will be held in Minneapolis, August 18.

GEORGE L. POWERS, *Secretary,*
Bank of Commerce Bldg.,
Memphis, Tenn.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The American Dental Hygienists' Association will meet at the Curtis Hotel, Minneapolis, August 20-23.

AGNES G. MORRIS, *Secretary,*
886 Main St.,
Bridgeport, Conn.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The American Dental Assistants Association will meet August 21-23, at the Leamington Hotel, Minneapolis.

RUTH F. ROGERS, *General Secretary,*
Rm. 803, 223 W. Jackson Blvd.,
Chicago, Ill.

UPSILON ALPHA SORORITY

The Upsilon Alpha Sorority will meet at a dinner, Wednesday, August 22. Make reservations with Dagny I. Just, 907 Yeates Bldg., Minneapolis.

DOROTHEA F. RADUSCH, *President,*
909 Metropolitan Bank Bldg.,
Minneapolis

XI PSI PHI

The Xi Psi Phi Fraternity will have headquarters at the Dyckman Hotel, Minneapolis, Room 211, during the Annual Session of the American Dental Association. Headquarters for the ladies will be Room 206. The annual banquet will be held August 20, at 6:30 p. m., at the Leamington Hotel. All members and their wives are welcome.

WILLIAM MCDOUGALL, *Chairman,*
Arrangements Committee,
426 Syndicate Bldg.,
Minneapolis, Minn.

PSI OMEGA FRATERNITY

The headquarters for the Psi Omega Fraternity will be the West Hotel, Minneapolis. Following is the program:

August 19—

Meeting of the Supreme Council, National Alumni Chapter, Officers and Local Committee, at 4 p. m.

August 20—

Registration and business meeting of the National Alumni Chapter, at 2 p. m.

Banquet, 7 p. m.

H. E. FRIESELL, *Supreme Grand Master,*
Schenley Apts.,
Pittsburgh, Pa.

DELTA SIGMA DELTA FRATERNITY

The forty-fourth annual meeting of the Supreme Chapter of Delta Sigma Delta Fraternity will be held in the Nicollet Hotel, Minneapolis, Minn., August 20. The Minneapolis Auxiliary Chapter extends to all our members an invitation to be present, with the assurance that all will receive a hearty welcome. The convention will be held in the Land of Ten Thousand Lakes, so do not forget fishing and camping equipment. The first session will be held at 9:30 a. m., and a second session immediately after lunch. Initiatory exercises will be held during the afternoon session. The banquet will be held at 6:30 p. m., at the Nicollet Hotel. Those expecting to attend should notify Brother Ralph Ackley, 1501 Glenwood Ave., Minneapolis, chairman of the Committee on Hotels and Reservations. For general information, consult Brother George Damon, LaSalle Bldg., Minneapolis.

By order of the Supreme Chapter,

FRANK MONROE CASTO,
Supreme Grand Master,
Keith Bldg.,
Cleveland, Ohio

R. HAMILL D. SWING,
Supreme Scribe,
Elrae Bldg.,
Philadelphia, Pa.

DIRECTORY OF COMMERCIAL EXHIBITORS

Abbott Laboratories, North Chicago, Ill.

Julius Aderer, Inc., 115 W. 45th St., New York City.

The Alkalol Company, 141 Washington St., Taunton, Mass.

The American Cabinet Company, Two Rivers, Wis.

American Salol Products Corp., 4446 Belmont Ave., Chicago, Ill.

The W. V-B. Ames Co., Fremont, Ohio.

The Anacin Co., 30 E. Kinzie St., Chicago, Ill.

The Antidolor Mfg. Co., Erie County, Springville, N. Y.

Archer Mfg. Co., Inc., Rochester, N. Y.

The Armand Company, Des Moines, Iowa.

Claudius Ash, Sons & Co., Inc., 1-3 Union Square W., New York City.

Bacon Manufacturing Company, 416 La Salle Bldg., Minneapolis, Minn.

The Barkmeyer Electrical Lab., 549 W. Washington Blvd., Chicago, Ill.

The Bayer Company, Inc., 117 Hudson St., New York City.

Becton, Dickinson & Co., Rutherford, N. J.

Belding Heminway Company, 68 Essex St., Boston, Mass.

Henry P. Boos, 608 Nicollet Ave., Minneapolis, Minn.

Harry J. Bosworth Company, 341 E. Ohio St., Chicago, Ill.

Bristol-Myers Company, 75 West St., New York City.

Brophy Dental Mfg. Company, 2833 S. Loomis St., Chicago, Ill.

Broughton-Singer & Co., 622 Nicollet Ave., Minneapolis, Minn.

A. A. Brown Dental Mfg. Co., 456 N. Boyle Ave., St. Louis, Mo.

Buck X-Ograph Co., 6629 Olive St., St. Louis, Mo.

Buffalo Dental Mfg. Co., 587 Main St., Buffalo, N. Y.

Burdick Cabinet Company, Milton, Wis.

Burns Dental Casting Machine Co., Inc., 88 State St., Flushing, N. Y.

Dr. John O. Butler, 1180 E. 63rd St., Chicago, Ill.

Cameron's Surgical Specialty Co., 666 W. Division St., Chicago, Ill.

Wilmot Castle Company, 1155 University Ave., Rochester, N. Y.

The L. D. Caulk Company, Milford, Del.

The Char-Tex Company, Des Moines, Iowa.

Chicago X-Ray Film & Mount Company, 4912 Lincoln Ave., Chicago, Ill.

The Cleveland Dental Mfg. Co., 3307 Scranton Road, S. W., Cleveland, Ohio.

Coe Laboratories, 25 E. Washington St., Chicago, Ill.

Colgate & Company, 581 Fifth Ave., New York City.

Columbia Dental & X-Ray Corp., 131 E. 23rd St., New York City.

The Columbus Dental Mfg. Co., 634 Wager St., Columbus, Ohio.

Cook Laboratories, Inc., 536 Lake Shore Drive, Chicago, Ill.

Corega Chemical Company, 208 St. Clair Ave., N. W., Cleveland, Ohio.

Corning Rubber Company, Inc., 266 Pearl St., Brooklyn, N. Y.

Crescent Dental Mfg. Co., 1839 S. Crawford Ave., Chicago, Ill.

Thomas J. Dee & Co., 5 S. Wabash Ave., Chicago, Ill.

Dental Items of Interest Publishing Co., 2921 Atlantic Ave., Brooklyn, N. Y.

Dental Products Co., 7512 Greenwood Ave., Chicago, Ill.

The Dental Specialty Co., 1638 California St., Denver, Colo.

The Dentists' Supply Co., 220 W. 42nd St., New York City.

The Denver Chemical Mfg. Co., 163 Varick St., New York City.

Deshell Laboratories, Inc., 536 Lake Shore Drive, Chicago, Ill.

Detroit Dental Mfg. Co., 6081 Twelfth St., Detroit, Mich.

The DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio.

August E. Drucker Company, 2226 Bush St., San Francisco, Calif.

Eastman Kodak Company, 343 State St., Rochester, N. Y.

Ehrhardt & Co., 179 N. Michigan Blvd., Chicago, Ill.

Eisele Gold Refinery, 201 City National Bank Bldg., Omaha Nebr.

Electro Dental Mfg. Co., 33rd and Arch Sts., Philadelphia, Pa.

Flossy Dental Company, Evanston, Ill.

Friedman Specialty Company, 25 E. Washington St., Chicago, Ill.

Garhart Dental Specialty Co., Hill Bldg., Union Square, Boston, Mass.

The Grant Dental Manufacturing Co., 403 Baltimore W., Detroit, Mich.

Hanau Engineering Company, 951 W. Ferry St., Buffalo, N. Y.

Hanovia Chemical & Mfg. Co., Chestnut St. and N. J. R. R. Ave., Newark, N. J.

The Harvard Company, 2206 13th St., Canton, Ohio.

The Heidbrink Company, 2633 4th Ave., S., Minneapolis, Minn.

The Hoffmann La Roche Chemical Works, 19 Cliff St., New York City.

Horlick's Malted Milk Corp., Racine, Wis.

The Hu-Friedy Mfg. Co., 3118 N. Rockwell St., Chicago, Ill.

The Iteco Company 287½ East Broadway, Portland, Ore.

J. W. Ivory, 310 N. 16th St., Philadelphia, Pa.

J. F. Jelenko & Co., 136 W. 52nd St., New York City.

Johnson & Johnson, New Brunswick, N. J.

Dr. R. R. Jones, La Salle Bldg., Minneapolis, Minn.

H. D. Justi & Son, 32nd and Spring Garden Sts., Philadelphia, Pa.

Dr. J. H. Kaplan, 25 E. Washington St., Chicago, Ill.

King's Specialty Company, 135 E. Washington St., Fort Wayne, Ind.

Miland A. Knapp, Inc., 1419 West Broadway, Minneapolis, Minn.

The Kolynos Company, 130 Bristol St., New Haven, Conn.

Henry G. Landberg Sales Company, 174 W. 3rd St., St. Paul, Minn.

H. R. Lathrop & Co., Inc., 110 Beekman St., New York City.

Lavoris Chemical Company, 918 N. 3rd St., Minneapolis, Minn.

Lea & Febiger, 600 S. Washington Square, Philadelphia, Pa.

L. LeLong & Bro., Inc., 345 Halsey St., Newark, N. J.

Lincoln Dental Mfg. Co., 1726 Sansom St., Philadelphia, Pa.

Carl A. Lineer, 601 Hamm Bldg., St. Paul, Minn.

The Lochhead Laboratories, Inc., 115 W. 45th St., New York City.

Martin Rubber Co., Inc., 327 Jackson Ave., Long Island, N. Y.

B. I. Martinez Co., 237 Hamm Bldg., St. Paul, Minn.

Mason Technical Corp., 3101 San Fernando Road, Los Angeles, Calif.

The McCaskey Register Company, S. Union Ave., Alliance, Ohio.

Mechanical Appliances Company, 263 S. Alexandria St., Los Angeles, Calif.

The Medical Protective Company, 35 E. Wacker Drive, Chicago, Ill.

William S. Merrell Company, 5th and Pike, Cincinnati, Ohio.

H. A. Metz Laboratories, Inc., 122 Hudson St., New York City.

Mizzy, Inc., 105 E. 16th St., New York City.

C. V. Mosby Company, 3616 Washington Blvd., St. Louis, Mo.

W. E Mowrey Company, 1436 University Ave., St. Paul, Minn.

The J. M. Ney Company, Elm and West Sts., Hartford, Conn.

Novocol Chemical Mfg. Co., 2923 Atlantic Ave., Brooklyn, N. Y.

The Ohio Chemical & Mfg. Co., 1177 Marquette St., Cleveland, Ohio.

Ora-Noid Company, 32 W. Randolph St., Chicago, Ill.

The E. L. Patch Company, Stoneham 80, Boston, Mass.

M. F. Patterson Dental Supply Co., 406 Sixth Ave., S., Minneapolis, Minn.

The Pelton & Crane Co., 632 Harper Ave., Detroit, Mich.

The Pepsodent Company, 1104 S. Wabash Ave., Chicago, Ill.

The David Perry Company, 622 Nicollet Ave., Minneapolis, Minn.

Chas. H. Phillips Chemical Co., 117 Hudson St., New York City.

Plant Company, 318 First Ave. N., Minneapolis, Minn.

Poloris Company, Inc., 79 E. 130th St., New York City.

Postum Cereal Company, Inc., Postum Bldg., New York City.

Premier Dental Laboratory, 305 Lowry Bldg., St. Paul, Minn.

Pro-phy-lac-tic Brush Company, Florence, Mass.

The Ransom and Randolph Company, Toledo, Ohio.

Rare Chemicals, Inc., 100 Fifth Ave., New York City.

Frank A. Reed, 507 Hamm Bldg., St. Paul, Minn.

Ritter Dental Mfg. Co., Inc., 404 West Ave., Rochester, N. Y.

Sal-Ora Chemical Company, 206 S. 6th St., Minneapolis, Minn.

Schering & Glatz, Inc., 41 Maiden Lane, New York City.

Lee S. Smith & Son Mfg. Co., Keenan Bldg., Pittsburgh, Pa.

The Sodiphene Company, 2531 Pennway, Kansas City, Mo.

Specialty Manufacturing Company, 39 Front St., Brooklyn, N. Y.

Spyco Smelting & Refining Co., 51 S. 3rd St., Minneapolis, Minn.

E. R. Squibb & Sons, 80 Beekman St., New York City.

I. Stern & Co., 218 W. 40th St., New York City.

Stevens-Fulton Company, 100 N. 7th St., Minneapolis, Minn.

Thermolite Products Corp., 213 N. Morgan St., Chicago, Ill.

Dr. Thompson's Sterile Toothbrush Co., 714 S. St. Clair St., Toledo, Ohio.

Toledo Technical Appliance Co., 2226 Ashland Ave., Toledo, Ohio.

Union Dental Instrument Mfg. Co., 831 Cherry St., Philadelphia, Pa.

Universal Dental Company, 48th and Brown Sts., Philadelphia, Pa.

Vernon Bros. & Co., 214 Stanwix St., Pittsburgh, Pa.

Victor X-Ray Corp., 2012 Jackson Blvd., Chicago, Ill.

Dr. L. P. Wagner, P. O. Box 895, Milwaukee, Wis.

Walling Bros., Inc., Springville, N. Y.

The Weber Dental Manufacturing Company, 4th and Cherry Sts., Canton, Ohio.

Weissfeld Bros., 474 Broadway, New York City.

The S. S. White Dental Mfg. Co., 211 S. 12th St., Philadelphia, Pa.

H. B. Wiggin's Sons Co., Bloomfield, N. J.

Williams Gold Refining Co., 2978 Main St., Buffalo, N. Y.

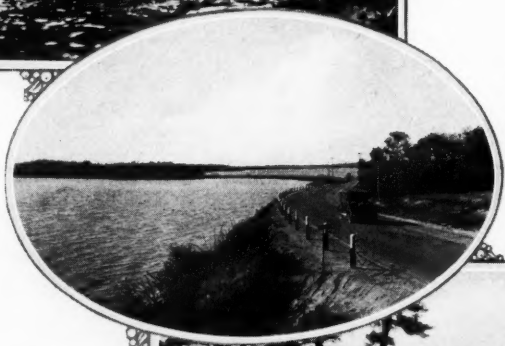
John H. Wood Company, 126 Market St. Philadelphia, Pa.

Hotel St. Paul,
St. Paul, Minn.

Lowry Hotel,
St. Paul, Minn.

Lake of the Isles. One of the five large lakes in the city limits of Minneapolis. A drive surrounds this lake, joining the "Grand Rounds" that link parks, playgrounds and lakes in a tree-bordered drive 56 miles long.

The northern shore of Lake Superior in Minnesota has an abundance of trout streams, among the most famous in the country.



Many of Minnesota's good roads wind around attractive lakes, leading to camping sites, forests passable only by canoe and portage and fishing and hunting areas.

Where the Mississippi begins. A view of Lake Itaska in Itaska State Park. A comfortable lodge is located here, and there are ample camping grounds.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Dermoid Cyst of the Mouth: In a discussion of dermoid cyst, covering the literature, location, embryology, histology, pathology, anatomy, diagnosis and treatment, J. V. Meigs (*New England J. Med.,* March 29, 1928) reports two cases, one of cyst below the mylohyoid muscle; one, above. A woman, aged 24, for three years has had a swelling under the right ramus of the mandible when eating or looking at anything that might cause salivation. She had always had a "double chin." An operation was unsuccessful. After the operative wound healed, a cystic area could be felt in the floor of the mouth with a small nodule of gland above, separated from the main cyst. A diagnosis of ranula was made. A second operation, under local anesthesia, exposed the sublingual gland, beneath which the thick, yellow, fibrous wall of a tumor was disclosed. The growth was about the size of an egg and very heavy. The patient's "double chin" was corrected with the removal of the growth. Swelling under the right ramus of the mandible continued to occur, but it was believed that it would eventually cease since the pressure on the salivary gland had been removed. In the second case, in a man, aged 35, there had been a swelling at the angle of the left jaw for a year and a half. The tumor seemed about the size of an egg and bulged slightly into the floor of the left side of the mouth. A diagnosis of ranula was made, but because of the previous case, dermoid cyst was considered a possibility. An incision parallel to the left jaw and exposing the submaxillary gland showed nothing until the gland was displaced, when a cyst wall similar to that in the first case was revealed, running toward the pharynx and midline above the hyoid bone. As in the former case, the growth was shelled out easily with a gloved finger. The submaxillary gland recovered its normal size rapidly and convalescence was otherwise prompt and uneventful.

Pain in Salivary Glands from Pressure of Denture: A care of swelling and pain in the submaxillary salivary glands caused by the pressure of a temporary vulcanite denture is reported by Bayford Underwood (*Dent. Surgeon,* Jan. 28, 1928). The denture was inserted one month after extraction of several teeth. The cuspids and bicuspids remained in the mandible. The patient reported three days after insertion of the denture, as directed, when he stated that he had been quite comfortable except for pain and swelling in the submaxillary region, which was worse during and after meals and which rapidly improved as soon as the lower denture was removed. Examination revealed definite enlargement of the submaxillary glands on both sides, with slight tenderness, and on further investigation, it was found that the openings to the submaxillary ducts were situated much further forward than usual. The orifices were red and swollen, but there was no evidence of undue pressure on the surrounding tissues. It was necessary to reduce the denture by half before the orifices were left clear. The patient has had no further trouble.

Arthroplasty for Ankylosis of the Jaw: Blair *(Surg., Gynec. & Obstet.)* pleads for the improvement of contour as well as for the restoration of movement. Correction or improvement in appearance may be accomplished by one, or a combination of several, of the following procedures: After the fixed joint is freed, the affected side of the mandible may be dragged forward and fixed in this position until the tendency to recede is overcome. At first the fixation is made by interdental wiring, but later the pull of a rubber band may be used. In unilateral ankylosis, with a receding mandible, it may be necessary to section the ramus of the opposite side to get the best attainable position of the body of the jaw. The receding chin can be built out by means of an implantation of costal cartilage. The facial

obliquity remaining after fixing the jaw bone in its new position can be rendered less noticeable by shifting the soft tissues of the chin laterally, by filling along the flat side of the jaw with cartilage, or by a combination of these.—Abstr. *J. A. M. A.*, March 31, 1928.

Present Status of School Hygiene: Dental Work: As regards dental defects which figure so largely in the general total, the medical examiner has been reporting only about 40 per cent of elementary children as having such defects when actually 90 to 95 per cent have an average of seven carious teeth. One reason for poor results in treatment of these defects has been that the medical inspector has found only advanced conditions chiefly in temporary teeth, the majority of which could not be really corrected if worth correcting. With the possibilities in prophylaxis developed through the work of the Forsyth Dental Infirmary it would seem that the chapter of dental work which dealt chiefly with rotting teeth can be closed, though it may take some time to open the new one in which these infinitely the most common of defects will be adequately dealt with. No matter whether we anticipate, or wait for, decay, dental defects should be dealt with at the earliest possible moment, and the examination for such conditions should be made by the dentist, dental hygienist or someone who knows the signs of beginning decay. We believe it is only a matter of time when the dental hygienist will be trained to do early fillings, the dentist being reserved for the more difficult and elaborate activities of his profession. In that advanced country, New Zealand, the routine work of the school dentist is done by such an assistant, and it would seem that most of such work could safely and economically be placed in her hands. Even by the older methods, where there is real interest in the matter, 100 per cent of corrections have been secured in some of our schools, and abroad, a thorough program has been carried out in at least one city at a surprisingly low cost and with the result that 90 per cent of the children now leave school with sound teeth.—James Frederick Rogers, in *Am. J. Pub. Health,* January, 1928.

Observations on Medicodental Research: Research workers may be divided into groups. There are some who, through special training, may be able to undertake experimental work under the guidance of those who may be conducting the research. Similar to this is the conducting of experimental research to verify or negative some work already done by others; or to try to show more exact results by working on a larger field or otherwise. Then there are those who essay the much more speculative attempt to throw light on the unknown. This is, of course, the important part of research, and it is really impossible to select or predict who may be successful in this. All that may be promised is perhaps that those with a good knowledge of the fundamental sciences and a special knowledge of the fundamental sciences and a special knowledge of the subject in hand, together with a persistent inclination to seek for the truth, are much likelier to be successful than those who think they can take up research work as a means of gaining a livelihood. There are far too many of this latter type, and it is particularly they who are at present doing so much harm. Usually they may be recognized by the marvellous work that has been done in the past in the particular line of research which they have taken up. —J. Sim Wallace, in *Oral Topics,* January, 1928.

How to Care for a Toothbrush: A toothbrush not properly cared for not only fails to bring about effective mechanical cleansing, but defeats the very purpose for which it is used, declares William M. Gardner in an article on the care of the toothbrush in the May *Hygeia.* A new brush should be placed in a strong cold salt solution for at least two hours before using, to set and clean the bristles and take away their original harshness. It should not be boiled. Every brush of good quality is sterilized by formaldehyde fumes before leaving the factory and does not need boiling, this writer says. The brush should be thoroughly rinsed with cold water after using, he advises. Do not keep it in a container. Containers prevent drying and encourage the growth of bacteria. If a brush is allowed to dry completely, most of the bacteria will die, since the bacteria of the mouth almost always require moisture and darkness for growth, Mr. Gardner says. Above all, do not use a worn out brush, the dentist says. A toothbrush should not be used more than four months and it is well to have two brushes, one for morning and one for evening brushing in order to allow them to dry thoroughly between times. The use of old brushes is a waste of time and may actually constitute a menace.

Palliative Treatment of Inoperable Cancer: Surgical diathermy is suggested by Joseph K. Narat (*Arch. Phys. Ther. X-Ray Rad.,* January, 1928) as a palliative in inoperable cancer. This treatment seals off the blood and lymph channels and so guards against metastasis. The heat reduces the growth to dead tissue and as much of it as possible can then be removed. Growth is retarded and the patient is made more comfortable, improvement in the general health being sometimes surprising. As sensory nerves are blocked off by the searing effect of the diathermy, pain is relieved so that the use of narcotics can be reserved for late stages of the disease. The fetor accompanying the disease is greatly ameliorated. A powder of benzoyl peroxid, aluminum stearate and bentonite is suggested as after-treatment.

Absence of Rickets in Mexico: Rickets does not exist in Mexico. Torroella (*Gaceta Med. de Mexico*) looked in vain for its stigmata among 6,000 children. The rachitic pelvis is likewise unknown. In the discussion Carrillo supported this statement as a result of 4,900 examinations in children and 500 in primiparae. Torroella thinks the richness in lime of Mexican foods and the prevalence of breast feeding as well as the abundant sunlight are preventive factors.—Abstr. *J. A. M. A.,* April 7, 1928.

Use of Roentgen Ray in Treatment of Pyorrhea Alveolaris: In several cases cited by the author (M. A. Lyons, in *Phys. Therapeutics*) roentgen rays have been of great value in the treatment of pyorrhea alveolaris. The spongy gums improved and the redness, soreness, bleeding and pus discharge cleared up. Only one failure in the series is noted. The roentgen-ray doses used are safe. The internal and external method is new. Sufficient time has elapsed to note the progress of these cases cited. Prompt treatment upon recognition of the disease influences the results. Roentgen-ray treatment allows dental work to be done at a later date.—Abstr. *Arch. Phys. Ther. X-Ray Rad.,* February, 1928.

Teaching Anesthesia in the Specialties: In dealing with the limitations of the courses covering anesthesia in dental and oral surgery, B. H. Harms (*Cur. Res. Anes. & Anal.,* March-April, 1928) suggests that the instruction in nitrous oxid-oxygen anesthesia is best handled as a postgraduate course with small groups of students. He believes that the subject of anesthesia can be covered only in a general way in the time set aside for it in the present dental curriculum.

Healing of Mouth Ulcer by High Frequency Current: Eight months ago, there appeared a very painful excessively secreting ulcer of the lower lip in a patient, a 36-year-old man, who gave a history of the triad of venereal diseases. The ulcer, despite all local treatment with caustics, grew in all directions in a very short time, so that at the time of the examination it was found to be on the inner mucous membrane of the mouth and the edges of the lips. The ulcer was of a pale color in contrast to the surrounding mucous membrane, and covered with a rather firm crust, the removal of which exposed a granular rather deep foundation which bled easily. The edges of the ulcer were undermined and surrounded by a wall of newly formed extremely hyperemic tissue. Pain was felt on pressure and there was a slightly enlarged lymph gland of the neck. Differential diagnosis wavered between ulcus syphiliticum, tuberculosum, sporotrichosicum, or leishmaniae. The appearance of the ulcer as well as the strong positive Wassermann reaction spoke in favor of ulcus syphiliticum. A strong anti-syphilitic treatment had no effect on the ulcer. Tests of the pus for tubercle bacilli, spirochetes, fungi and leishmaniae were negative. Animal tests yielded no characteristic tuberculous changes of the tissues. Calcium iodid and tartar emetic, without radiotherapy, were used with only transient success. The histological investigation of an exudated particle of the ulcer finally cleared up the matter in that it yielded definite proof of the tuberculous nature of the ulcer. The authors (Cunha and Provioa, in *Brazil Med.*) then succeeded in obtaining a remarkable improvement in only two weeks by the application of the high frequency current. The improvement continued, so that, in less than a month, the ulcer was entirely gone. Besides the high frequency current, no other therapy was applied, nor was the mode of life of the patient altered.—Abstr. *Fortschr. d. Med.,* per *Arch. Phys. Ther. X-Ray,* February, 1928.

Ethylene-Oxygen Anesthesia: As a result of these observations by experienced clinicians a report was issued which in a word was to the effect: (1) that ethylene was particularly the anesthetic of choice in the

newly born and the aged; and (2) that this anesthetic agent (like nitrous oxid) was devoid of any untoward pharmacological properties which operated in an unfavorable manner on the patient, either at the time of its administration or subsequently. These claims have not been controverted seriously by anyone since they were first made, except by some who were unwittingly actuated solely by ultraconservatism in doing so. May I be permitted to indicate incidentally that the introduction of this anesthetic agent established the superiority of gas-oxygen anesthesia generally.—Arno B. Luckhardt, in *Cur. Res. Anes. & Anal.*, January-February, 1928.

Metastatic Hypernephroma of the Jaw: A case of hypernephroma of the jaw with metastases is reported by Branch and Norton *(New England J. Med.*, May 3, 1928), in a woman, aged 64. The patient complained of an inability to swallow. For a year and a half, her dentist had tried unsuccessfully to close a discharging fistula on the lingual surface of the mandible opposite the lower right second bicuspid. The treatment had consisted of pumping 5 per cent phenol through the root canal of the tooth, out through the fistulous opening. The dentist became alarmed because a growth, which resembled an epulis, was developing about the fistula. The area involved was removed by radical operation and the actual cautery was applied, apparently eliminating the growth, which was reported by the pathologist to be an epidermoid carcinoma. Within five months the growth recurred and radium was implanted. About this time, a fall injured the spine and left hip. The right side of the mouth and the contiguous portion of the tongue showed a marked pathologic condition, having a "chewed out" appearance as though tissue had been surgically removed. Roentgen-ray examination showed increased density of both lungs, suggestive of tumor metastasis. One month after recurrence of the growth, a left-sided hemiplegia and an increase in rate, with irregularity, of the heart developed, and death ensued. The clinical diagnosis was carcinoma of the tongue. Necropsy was followed by the pathologic diagnosis of hypernephroma of the left kidney; metastases to right kidney, liver, lungs and jaw, and slight coronary sclerosis, mitral and aortic sclerosis, general arteriosclerosis and bronchopneumonia. Microscopic diagnosis was hypernephroma of the left kidney; metastasis to right kidney, liver, lungs and jaw, and slight bronchopneumonia.

Treatment of Vincent's Angina: Reaves *(Arch. Otolaryngol.)* recommends the use of 2 per cent solution of a mixture of acriflavine and gentian violet, equal parts, in the treatment of Vincent's angina. He says that one application a day will relieve the patient of pain in about two days, and will effect a cure in about five days. In his experience, this has been a specific treatment for Vincent's angina.—Abstr. *J. A. M. A.*, April 14, 1928.

Radium and Radon in Treatment of Epithelioma of Lip: The advantages of radon, a radioactive gas which is extracted from an aqueous solution of radium chlorid, over radium in the treatment of carcinoma is stressed by Simpson and Flesher *(Arch. Phys. Ther. X-Ray Rad.*, March, 1928), who have used radon exclusively since 1919. In intra-oral cancer, tissue is removed for microscopic examination, but in lip cancer the diagnosis is clinical in practically all cases. Large doses applied to the surface of the lesion for short periods are greatly to be preferred to small doses used for long periods. It is suggested that prognosis be guarded if the lymph nodes of the neck are involved and, in view of reports covering a large series of cases, that all cases with glandular involvement be considered inoperable if more than one submaxillary gland is affected. In a period of four years, seventy-four primary cases of epithelioma of the lower lip treated by radon showed 16.3 per cent involvement of lymph nodes. In fifty-seven patients carefully traced (three of which had palpable lymph nodes), forty-seven have been clinically well for from three and a half to seven years.

Harelip and Cleft Palate: Dr. Coe advised operation of the lip when the baby weighs 12 pounds and closing of the soft palate as soon as a good recovery is made. The hard palate should be closed later. In two cases which he reported, he used a Logan traction bow and paid scrupulous attention to keeping the lip wound clean following the operation.—*Am. J. Dis. Child.*, May, 1928.

MISCELLANY

BOOK REVIEWS

Bone as a Measure of Development. When and How We Acquired Our Teeth. By J. S. Foote, A.M., M.D., LL.D. Illustrated. 182 pages. Published by the Scientific Foundation and Research Commission of the American Dental Association, 58 E. Washington St., Chicago, Ill.

The more one studies this book, the more one is impressed with the irreparable loss sustained by the profession and humanity when the author died. Dr. Foote was not only a scientist: he was a scientist with a vision.

The presentation of this work to the profession is due more than anything else to the devotion of one of the Trustees of the American Dental Association. Edward H. Bruening, whose interest in the subject and whose loyalty to the memory of Dr. Foote were the chief incentives which brought the idea of publication to fruition.

The volume is divided into four books: "Bone as a Measure of Development;" and "When and How We Acquired Our Teeth: Part One—Fishes; Part Two—Amphibians; Part Three—Reptiles."

To attempt a detailed review of this splendid work in the limits of a magazine notice is quite impossible. There has seldom been presented to the profession a work embodying deeper thought or more profound reasoning than this. Dr. Foote's emphasis on the significance of bone as an index to the trend of the human race is only one angle to his reasoning. He deals with some of the most fundamental questions of our existence and our heredity, and presents a picture as represented in the story of bone development that is not only intensely interesting but also scientifically significant.

He closes the first part of the book with this encouraging observation:

"It is not necessary to perpetuate the lower levels of society simply because we have them; it is only necessary that we recognize their cause and understand the social conditions which maintain those causes and then gradually eliminate or reduce them by the application of biological methods. We cannot change low types of structure to high, nor attributes from one level to another by chance or by legislation, we must change the foundation upon which they rest.

Our biographies are written in our bones and are told by our characters; we cannot change the past, nor the present, but we can change the future."

This is the keynote of the work, and dentistry is blessed in the fact that such a man lived and worked in our midst.

Folk Lore of the Teeth. By Leo Kanner, M.D., Yankton State Hospital, Yankton, S. D. Illustrated. 316 pages. Price, $4.00. Published by The Macmillan Company, New York.

This book is unique in dental literature. Fragmentary articles have from time to time appeared in our periodicals, all of which have been very interesting; but this is the most ambitious attempt that has ever been made to portray the various phases of folk lore as it applies to the teeth.

The author modestly says in his preface: "I wish to emphasize that I look upon this book as a rudiment, or as a skeleton around which a public with aroused interest in its contents will gradually build up a real living body." And yet it must be recalled that it has taken years of study and observation to collect all the material which goes to make up this volume.

Inlays of gold, turquoise, rock crystal, red cement, etc., are referred to as having been used for decoration rather than to fill decayed cavities. It is stated that Cortez, about 300 years ago, found such specimens in the ruins of a town in Guatemala. There are illustrations showing the martyrdom of Saint Apollonia, wood cuts from the year 1473 and the seventeenth century, the originals of which are in the University library of Basle, and the picture gallery in Dresden.

To those who love to delve into the quaint customs and conceits of the early ages, this book will prove of great interest, and while,

as the author intimates, the subject is by no means exhausted, enough has been presented to make a most entertaining volume.

NEWS

American Academy of Restorative Dentistry: The following are officers of the newly organized American Academy of Restorative Dentistry: President, Theodore W. Maves, Cleveland, Ohio; president elect, Nye White Goodman, Los Angeles, Calif.; secretary-treasurer, Ralph L. Morrison, Washington, D. C. The council is composed of A. L. LeGro, Detroit, Mich.; J. C. Mortonson, Milwaukee, Wis.; H. A. Maves, Minneapolis, Minn.; Charles Lane, Detroit, Mich.; C. W. Hoffer, Nashville, Tenn.; E. L. Knox, Dallas, Texas.

Vermont Board of Dental Examiners: The following make up the Vermont State Board of Dental Examiners: David Manson, Burlington; P. M. Williams, Rutland; Fred R. Newell, Brattleboro; F. H. Brown, Enosburg Falls; George M. Somers, Proctor.

Cleveland Dental Society Officers: Recently elected officers of the Cleveland Dental Society are: President, J. A. Loughry; secretary, T. J. McDermott; treasurer, C. J. Stark.

Expedition to Study Teeth of Pygmies: A group of research men sailed from New York June 2, for London, on the first lap of their journey to Cape Town, South Africa. It is their plan to go by motor truck into the Kalahari Desert country to study dental conditions among the pygmies. It is expected that the expedition will require two years for completion of the work contemplated.

Deaths from Radium Paint: It is reported that the number of deaths from radium poison among the workers in two eastern firms whose employes have come in constant contact with radium paint in their daily work has reached seventeen. Approximately 300 women workers are now under medical observation. The first manifestations of the poisoning are seen in the gums and teeth.

Negro Dentists Set Up Clinic in Liberia: According to *Hettinger's Dental News,* two young negro dentists, recent graduates of Marquette University School of Dentistry, have departed for Liberia, on the west coast of equatorial Africa, to set up a dental clinic to care for the natives of that republic, who according to reports, now have to walk from 50 to 100 miles for medical and dental care.

Perfect Teeth Among University Students: Only ten students of the University of California among 3,000 examined during the last year at the university infirmary have what might be classified as perfect teeth, according to a survey made by J. F. Cathcart, under the direction of Prof. Forrest H. Orton of the college of dentistry. During examinations, fifty cases were selected in which the teeth were perfect as far as general development and cavities were concerned. Casts were made of these and they were studied for perfection as to occlusion and general placement in the jaw. Of the fifty, only ten proved to be good in all respects. Dr. Cathcart is now tracing the life histories of the students whose teeth are above average, and his work thus far indicates that none of them in this class were bottle-fed babies. They were breast-fed for at least seven months. He believes that breast feeding is valuable in the development of the jaws and teeth because of the physical effort required of the child.—*J. A. M. A.*

State Society Officers: Newly elected state society officers are as follows:

Arkansas: President, Nolan Helstern, Springdale; president elect, C. C. Howard, Jonesboro; vice president, J. D. Jordan, Little Rock; secretary-treasurer, I. M. Sternberg, Fort Smith.

Connecticut: President, Joseph W. Borchardt, Waterbury; first vice president, William L. Weed, South Norwalk; second vice president, Albert E. Cary, Hartford; secretary-treasurer, Clarence E. Peterson, Rockville.

Illinois: President, A. E. Converse, Springfield; president elect, Hart J. Goslee, Chicago; vice president, B. H. Sherrard, Rock Island; secretary, A. B. Patterson, Joliet; treasurer, E. L. Burroughs, Edwardsville.

Indiana: President, W. R. Meeker, Peru; president elect, V. H. Knapp, Evansville; secretary, C. L. Byers, Indianapolis; treasurer, W. C. Hessler, Crawfordsville.

Iowa: President, Earle S. Smith, Iowa City; president elect, C. E. Westwood, Sioux City; vice president, Carl B. Miller, Des Moines; secretary, John Scholten, Cedar Rapids; treasurer, Frank Fourt, Fairfield.

Kansas: President, Homer B. Robinson, Great Bend; president elect, C. K. Weaver, Clay Center; secretary, Fred A. Richmond, Kansas City; treasurer, W. T. Triplett, Salina.

Maryland: President, E. W. Swinehart, Baltimore; president elect, Wiley W. Smith, Baltimore; vice president, D. C. Blevins, Centerville; secretary, Norval H. McDonald, Baltimore; treasurer, Walter E. Green, Baltimore.

Massachusetts: President, Charles W. Hammett, Taunton; president elect, Thomas K. Ross, Fitchburg; vice president, Frank A. Delabarre, Boston; secretary, William H. Gilpatric, Boston; treasurer, Joseph T. Paul, Boston.

Michigan: President, P. C. Lowery, Detroit; president elect, P. J. O'Reilly, Detroit; vice president, E. G. Robbins, Ishpeming; secretary, William R. Davis, Lansing; treasurer, Edwin J. Chamberlin, Grand Rapids.

Missouri: President, C. B. Coleman, Poplar Bluff; president elect, Edgar H. Keys, St. Louis; secretary, Charles W. Digges, Columbia; treasurer, J. F. McLellan, Moberly.

North Dakota: President, R. W. Pote, Fargo; vice president, C. E. Johnson, Valley City; secretary, L. I. Gilbert, Fargo; treasurer, L. E. Musberger, Jamestown.

Pennsylvania: President, W. P. Fordham, Scranton; first vice president, Z. T. Jackway, Philadelphia; second vice president, A. C. Young, Pittsburgh; recording secretary, C. W. Hagan, Swissvale.

South Dakota: President, Robert Jasman, Sioux Falls; president elect, Harry Y. Mann, Mobridge; secretary, Ernest W. Elmen, Sioux Falls; treasurer, J. W. King, Aberdeen.

Tennessee: President, William F. Stone, Chattanooga; president elect, E. S. Landess, Fayetteville; vice presidents, W. B. Clotworthy, Knoxville, W. E. Ikard, Decherd, and J. H. Meeks, Humboldt; secretary-treasurer, J. J. Reavis, Lawrenceburg.

Vermont: President, George D. Samson, Burlington; first vice president, Carter R. Woods, Rutland; second vice president, P. Mahoney, Burlington; secretary, Lloyd C. Robinson, Morrisville; treasurer, Howard F. Killary, Burlington.

West Virginia: President, Frank L. Wright, Wheeling; president elect, F. M. Farnsworth, Buckhannon; vice president, H. H. Smallridge, Charleston; secretary, J. E. Herbert, Martinsburg; treasurer, J. S. Stone, Clarksburg.

Deaths

Arbuckle, J. Henry, Delhi, N. Y.; New York College of Dentistry, 1897; died, May 5, of heart disease; aged 53.

Bennett, Harry C., New York City; University of Buffalo, School of Dentistry, 1900; died, May 18, of pneumonia; aged 49.

Bentley, W. H., Newark, N. J.; New York College of Dentistry, 1911; died, May 3, of pneumonia; aged 48.

Bradfield, Thomas Naylor, Newark, N. J.; New York College of Dentistry, 1891; died, April 19; aged 54.

Brayton, Clinton D., Lake Mills, Wis.; died, April 25; aged 81. Dr. Brayton continued in practice up to the time of his death.

Burns, Walter F., East Orange, N. J.; School of Dentistry, University of Pennsylvania, 1921; died May 15, of blood poisoning, due to a cut on the finger received in his office work a few days before; aged 32.

Clapp, E. A., Livonia, N. Y.; died, March 17; aged 72.

Conlon, Hugh D., Niles, Ohio; Western Reserve University School of Dentistry, 1914; was killed, April 26, when his automobile crashed into an abutment. Dr. Conlon was 34 years of age.

Deming, F. Reno, Detroit, Mich.; Detroit College of Medicine, Department of Dental Surgery, 1894; died, May 17; aged 56.

Gilbert, S. Eldred, Philadelphia, Pa.; Pennsylvania Dental College and Hospital of Oral Surgery, 1880; died April 29, of pneumonia; aged 76.

Hausmann, Karl, Kewaskum, Wis.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1905; died, April 20, after a lingering illness.

Henshie, R. E., Taylorville, Ill.; Indiana University, School of Dentistry, 1892; died, May 8; aged 69.

Kinsley, Burt, Perrysburg, Ohio; University of Michigan, College of Dentistry, 1908; died suddenly, April 26; aged 52. Dr. Kinsley was a veteran of the Spanish-American War.

M'Lernon, Thomas James, Camden, N. J.; Temple University School of Dentistry, 1896; died, May 4. Dr. M'Lernon was at one time dean of the Western Reserve University, College of Dentistry, and later dean of the University of Iowa, College of Dentistry.

Malmgren, Robert V., Willmar, Minn.; University of Minnesota, College of Dentistry, 1906; died, May 12; aged 46.

McDill, Joseph Worrell, Cleveland, Ohio; Western Reserve University, School of Dentistry, 1898; died recently.

Palmer, Joseph W., Fitchburg, Mass.; Temple University School of Dentistry, 1873; died, April 25; aged 80.

Reynolds, J. C., Mayfield, Ky.; died, May 10; aged 84. Dr. Reynolds was in practice sixty-five years.

Rush, Rivers A., Mobile, Ala.; Vanderbilt University School of Dentistry, 1891; died suddenly, May 16; aged 58. Dr. Rush was a past president of the Alabama State Dental Society.

Sprout, Boyd B., South Williamsport, Pa.; School of Dentistry of the University of Pennsylvania, 1900; died, April 21; aged 50.

Trezona, William, Hurley, Wis.; Marquette University School of Dentistry, 1900; died, May 15; aged 57.

Walker, John A., Detroit, Mich.; Detroit College of Dentistry, 1900; died April 6; aged 55.

Williams, William B., Garden City, Kan.; Kansas City Dental College, 1911; died, May 2.

ANNOUNCEMENTS

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, August 20-24, 1928, Minneapolis, Minn.

American Academy of Periodontology, August 16-18, 1928, Minneapolis, Minn.

American Academy of Restorative Dentistry, August 17-18, 1928, Minneapolis, Minn.

American Dental Assistants Association, August 21-23, 1928, Minneapolis, Minn.

American Dental Hygienists Association, August 20-23, 1928, Minneapolis, Minn.

American Dental Society of Europe, July 30-August 1, 1928, Brussels, Belgium.

American Society of Oral Surgeons and Exodontists, August 17-18, 1928, Minneapolis, Minn.

Federation of American Women Dentists, August 20, 1928, Minneapolis, Minn.

National Association of Dental Examiners, August 18, 1928, Minneapolis, Minn.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

July (1928)

Wyoming, at Casper (9-10).

September (1928)

Maryland, at Annapolis (10-11).

December (1928)

Ohio, at Toledo (4-6).

May (1929)

West Virginia, at White Sulphur Springs (20-22).

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

North Dakota, at Fargo, July 10-13, 1928. Secretary, Gilbert Moskau, Grand Forks, N. D.

FIRST DISTRICT DENTAL SOCIETY OF THE STATE OF NEW YORK

The First District Dental Society of the State of New York will hold its fourth annual December Meeting for Better Dentistry at the Hotel Pennsylvania, New York City, Dec. 3-6, 1928. The committee is arranging a meeting of the same standard as those of former years. Essayists and clinicians eminent in their fields are being invited and an announcement of their personnel will be made at an early date. This year, the meet-

ing will continue for four days and the same plan of subscription will be continued.

There will be a manufacturers' exhibit in the hotel during the continuance of this meeting.

JOHN T. HANKS, *Chairman*

MARYLAND STATE DENTAL ASSOCIATION

The semi-annual meeting of the Maryland State Dental Association will be held at Annapolis, September 10-11. The next annual meeting will be held May 6-8, 1929, at Baltimore.

NORVAL H. MCDONALD, *Secretary*
Medical Arts Bldg.,
Baltimore

WEST VIRGINIA STATE DENTAL SOCIETY

The twenty-third annual meeting of the West Virginia State Dental Society will be held at White Sulphur Springs, May 20-22, 1929.

J. E. HERBERT,
Daniels-Wallace Bldg.,
Martinsburg, W. Va.

FIRST DISTRICT DENTAL SOCIETY OF THE STATE OF NEW YORK: THE MORRIS L. CHAIM and THE BENJAMIN LORD PRIZE FOR 1928

The First District Dental Society of the State of New York announces a prize of $250 offered by the Morris L. Chaim Fund and a prize of $150 offered by the Benjamin J. Lord Fund, to be known as the Morris L. Chaim Prize and the Benjamin Lord Prize, respectively. These prizes are to be awarded annually at the discretion of the board of directors.

Conditions:

1. Eligibility. Member in good standing of any bona fide dental, medical, or scientific society, or duly registered student of a recognized educational institution, prior to submission of the manuscript.
2. Date. Papers are to be submitted on or prior to Nov. 1, 1928, to the secretary of the First District Dental Society, 2 East 103d Street, New York City.
3. Papers.
   A. The Morris L. Chaim Prize is offered for the most acceptable paper in the field of science and art as related to dentistry which embodies the results of original research not previously published.
   B. The Benjamin Lord Prize is offered for the most acceptable paper in the field of clinical dentistry having an immediate and direct value in its application to practical needs, and which embodies the results of original research not previously published.

The manuscript shall be typewritten, and accompanied by all necessary photographs, drawings, diagrams and tables, and shall be ready for publication.

The manuscript and all drawings, diagrams, photographs, tables, data, etc., shall be sealed in a plain wrapper or envelop which shall bear on the outside some symbol, group of letters, figures or other identification mark, and accompanying each such sealed packet or envelop, another sealed envelop having on the outside a duplicate of such symbol, group of letters, figures or other mark, and within this sealed envelop shall be placed the name and address of the person submitting the manuscript, etc.

4. Award. The award shall be made by the Board of Directors of the First District Dental Society of the State of New York. At the discretion of the board, the prizes may be divided between the papers adjudged to be of equal merit, or both prizes awarded for one paper, if, in the opinion of the judges, it merits them.
5. Publication. The First District Dental Society of the State of New York will consider the publication of the successful papers, but publication by the First District Dental Society of the State of New York shall not be binding on either party.
6. Wherever and whenever published, the papers awarded the prizes shall be accompanied by the statement: "Awarded the Morris L. Chaim (or the Benjamin Lord Prize, or both), in 1928 by the First District Dental Society of the State of New York."

Further information can be had by addressing: E. M. Davies, General Secretary, First District Dental Society, New York Academy of Medicine, 2 East 103d Street, New York City.

HOTELS	Rooms	WITH BATH		WITHOUT BATH	
		One Person	Two Persons	One Person	Two Persons
RADISSON 7th St. between Hennepin & Nicollet	500	$3.00-6.50	$5.00-30.00	$2.00-2.75	$4.00
NICOLLET Washington at Nicollet	600	2.50-6.00	4.00-8.00	2.00	3.50
CURTIS 10th St. & 4th Ave. S.	825	2.00-3.00	3.00-6.00		
LEAMINGTON 3rd Ave. S. at 10th St.	500	2.50-4.50	3.50-6.00		
SHERIDAN 1112 Marquette	450	2.50 up	3.50 up	1.50 up	2.50 up
ANDREWS Hennepin & 8th St.	328	2.50-6.00	4.00-7.00	2.00-2.50	3.00-3.50
BUCKINGHAM LaSalle & 15th St.	138	2.50-3.50	4.00-6.00		
CAMFIELD Marquette & 8th St.	100	1.50-1.75	2.50	1.25	2.00
DYCKMAN 6th St. between Hennepin & Nicollet	300	2.00-5.00	4.00-7.00		
FRANCIS DRAKE 10th St. & 5th Ave. S.	160	2.50-5.00	3.50-6.00		
ELGIN Hennepin & 8th St.	125	1.50	3.00 up	1.00	2.00 up
HASTINGS 12th St. & Hawthorne	150	1.75-4.00	2.50-5.00		
MARYLAND LaSalle & Grant	172	2.00-2.50	3.00-3.50		
PLAZA Kenwood Parkway & Hennepin	160	2.50-6.00	3.50-6.00		
PAULY Nicollet & High	48			1.00-1.50	1.50-2.00
ROGERS Nicollet & 4th St.	200	2.00-2.50	3.50-5.00	1.25-1.50	2.50
RUSSELL 16 S. 4th St.	125	1.50-2.50	2.50-4.00	1.25-1.50	2.00-3.00
SENATOR 314 S. 8th St.	80	2.00 up	3.00 up		
ST. REGIS Marquette & 9th St.	58	1.50-3.00	2.50-4.00		
VENDOME 4th St. between Hennepin & Nicollet	250	1.75	3.00-3.50	1.25-1.50	2.00-2.50
WEST Hennepin & 5th St.	362	2.00-4.00	3.00-5.00	1.50-2.00	2.50-3.00

AMERICAN DENTAL ASSOCIATION

Minneapolis, Minnesota. August 20 to 24, 1928.

HOTEL RESERVATION

The Housing Committee for the American Dental Association meeting in Minneapolis has compiled a roster of hotels approved by the Minneapolis Civic and Commerce Association and the Hotel Association.

Please be accurate in filling out the reservation form below and send it to the hotel of your first choice. You will be advised by the hotel of the receipt and listing of your reservation.

In the event that the reservation of your first choice cannot be made, the hotel manager will forward this blank to the Chairman of the Halls and Hotels Committee. He will place your reservation under either your second or third choice; or, if these are not available, in as favorable a hotel as possible. You will be advised of the name and location of the hotel in which the reservation is made and the hour at which the reservation begins. Rooms not occupied at the designated hour of the reservation may be reassigned by the hotel.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations that you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel releasing it, in order that your room may be made available for other members.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, MINNEAPOLIS, MINN., AUG. 20 TO 24, 1928

.....Hotel.

Minneapolis, Minn.

Dear Sir: Please make reservations noted below:

.....rooms with bath for.....persons. Rate: $.....to $.....per day per room

.....rooms without bath for.....persons. Rate: $.....to $.....per day per room

Date of arrival.....Hour.....

Date of leaving.....

Please note the following second and third choice of hotels:

Second choice.....

Third choice.....

Room or rooms will be occupied by

NAME	ADDRESS IN FULL
.....	.....
.....	.....

Name of applicant.....

Street and number.....City and State.....

Please confirm this reservation to applicant. I further agree to notify the hotel immediately in event I am unable to use this reservation.

Important to hotel manager:—In event that you cannot accept this reservation, please forward this application at once to Dr. W. C. Naegeli, Chairman Halls and Hotels Committee, American Dental Association, 301 Donaldson Bldg., Minneapolis, Minn., who will attend to the assignment of this reservation.

SOME PACKAGE LIBRARIES*

Compiled by, and Available for Circulation from

THE LIBRARY BUREAU†

American Dental Association
58 E. Washington St.,
Chicago, Ill.

Amalgam fillings and physical properties of amalgam.
Cast gold inlays.
Cleft lip and palate.
Comparative dental anatomy.
Cysts.
Dental caries.
Dental cements.
Dental hygienists.
Dental materia medica and therapeutics.
Diet and nutrition in relation to teeth.
Endocrine glands in relation to teeth.
Esthetics in denture construction.
Ethics.
Ethylene anesthesia.
Etiology of malocclusion and preventive orthodontia.
Extraction of teeth.
Focal infection in relation to diseases of the eye.
Fractures of the jaws.
Full denture construction.
Habits in relation to malocclusion.
Impression technic.
Industrial dental service.
Ionic medication.
Local anesthesia.
Materials for denture construction.
Muscle exercises and training in orthodontia.
Nitrous oxid oxygen anesthesia.
Oral diagnosis.
Oral manifestations of systemic conditions.
Partial denture construction.
Preparation of cavities with hypersensitive dentin.
Procain (novocain) dermatitis.
Pulp conservation including discussions and methods of pulp capping.
Root canal treatment.
Studies of saliva.
Surgical treatment of pyorrhea.
Trigeminal neuralgia.
Tuberculosis and dentistry.
Ultraviolet ray in dentistry.

*Each package contains information on one of the subjects listed above and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned for a period of one week after date of receipt. The charge for borrowing a package library is 50 cents. No packages are sold. A list of package libraries was also published in the January, 1928, issue of THE JOURNAL, page 200. In response to requests, packages will be compiled on other subjects pertaining to dentistry.

†Formerly the Department of Literary Research.